Carl R. Hartrampf, Jr.

Transverse Abdominal Island Flap Technique

For Breast Reconstruction After Mastectomy

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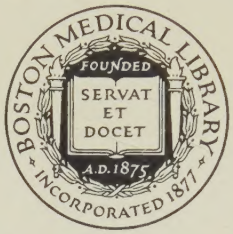

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Transverse Abdominal Island Flap Technique

for Breast Reconstruction after Mastectomy

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Transverse Abdominal Island Flap Technique

for Breast Reconstruction after Mastectomy

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Dedicated to our Families
for their understanding, love and support
especially during the preparation of this manuscript.

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This monograph and videobook were made possible through the combined efforts of a number of individuals. First in our minds are the pioneer patients who were willing to undergo a new and untried procedure, and subsequently to share their experience with other mastectomy patients. Dr. Paul Black—friend, colleague, and trusted sounding board—was unfailing in his support and sagacious advice. Dr. Thomas A. Cronin, a leader in the field of breast reconstruction, gave much needed encouragement in the early stages of the development of this surgery. The operating team concept is important with this procedure, and Dr. Luther Rollins has become an indispensable part of our team.

The staff and Sisters at the Saint Joseph's Hospital, Atlanta, Georgia, where the first transverse abdominal island flap operation was performed, have our eternal gratitude for their tolerance and support during the formative period of this operation and for their compassionate care of the breast reconstruction patients. Dr. Parry Soder and the Department of Radiology deserve a special thanks for the arteriograms that so clearly demonstrated the deep epigastric arterial system in the early patients, and the Department of Anesthesiology is to be commended for designing a reliable anesthesia routine for this new operation.

The plastic surgery resident continues to be a vital part of this organization, and Dr. Leonard Miller, the current resident, has been a significant contributor to this work.

The entire office staff at the Atlanta Plastic Surgery Clinic has been helpful in many ways, especially Isla Caraway, Nancy Cadora, Sandy Smith, Sarah Simmons, and Dot Adcox, all of whom truly went the extra mile.

We are indebted to Larry W. Carter of University Park Press for suggesting the videobook format which we think is uniquely suited to the teaching of this operation.

CRH and PCH

Foreword

Luis O. Vasconez

As surgeons we take pleasure in new operative procedures, particularly when the result is gratifying as in reconstructing a breast so that it matches the contralateral one. Not too many years back, when we explained about the transfer of tissue with the latissimus dorsi method of reconstruction, patients would jokingly say, "Why don't you take the tissue from here [pointing to the abdomen] and put it in my breast." It was left to Carl Hartrampf to design what I consider to be the most ingenious operative procedure ever devised in reconstructive plastic surgery.

Previous attempts had been made to use tissue from the lower abdomen, especially by Fernandez and his group of South American plastic surgeons. Their superior results had the disadvantage of multiple operative procedures and occasionally partial flap necrosis. To bring up tissue from the lower abdomen to the chest in one operative procedure and to mold it in the form of a breast was unheard of just a few years ago. It has now been made possible, however, by the accumulated knowledge of myocutaneous flaps, the demonstration via microvascular surgery that a 1-mm vessel can carry a considerable amount of skin, refinements in operative techniques, and learning how to obtain projection and ptosis in breast reconstruction.

However, there is more to a new operative procedure than just the technique itself. It must be made safe; it should be so simple that everyone can do it; and it should obtain the desired effect—in this case, symmetry with the opposite breast.

Dr. Hartrampf has worked assiduously and constantly to obtain these objectives. In his hands, this procedure is not only safe but elegant. He takes only the central portion of the rectus abdominus muscle, sparing the lateral and medial portions. He also saves the junction of the oblique muscles with the rectus sheath, which is very important in maintaining the integrity and strength of the abdominal wall. The importance of the periumbilical perforators is emphasized, and a portion of the rectus sheath is included, which increases the safety of the flap.

In addition, there are a number of details that Dr. Hartrampf demonstrates that play a role in the safety of the operative procedure, such as his pretreatment of patients with isoxsuprine, the use of "cc-for-cc" intraoperative blood replacement, the postoperative position of the patient, and his willingness to reoperate if the flap appears compromised. These factors all deserve careful evaluation and study, and one should resist an initial impetuous tendency to discard them.

In our own unit we have confirmed that peripheral tissue hypoxia is a frequent accompaniment to a wide range of operative procedures, even when we think that the circulatory volume is adequately replaced. Significant tissue hypoxia

also exists in patients undergoing myocutaneous flap transfer. This is corrected by additional infusion of blood and fluid as well as the use of nasal oxygen.

At first the operative procedure does not appear simple, and one marvels at how easy it seems when watching Dr. Hartrampf perform it. It is reproducible, however, and is being done successfully throughout the world. Unfortunately, most of us have not been doing Dr. Hartrampf's operation. We have applied principles of other myocutaneous flaps and, on the basis of inadequate information and knowledge, perform the surgery with modifications that more often than not make it more difficult and less safe. Furthermore, there is more than just getting the tissue up into the chest successfully. There must be a plan and an objective. The latter is to match the opposite breast with its projection and a certain amount of ptosis.

Dr. Hartrampf knows intuitively how to obtain symmetry, and he imparts this information in a clear and straightforward manner. Careful measurements of the normal breast are transferred to the design of the flap and to the contour of the new breast. His guidelines, which can hardly be labeled "cookbook," help us enormously in shaping the breast. Finally, Dr. Hartrampf has devised and demonstrated an excellent method of nipple reconstruction applicable to this flap, one that gives a lasting projection and symmetry.

The format of this instructional text is unique and indeed most welcome. We not only read about the operative procedure but see it performed by the master, who shows us its pitfalls and the areas of concern.

Professor of Surgery and Chief
Division of Plastic and Reconstructive Surgery
University of California, San Francisco

Preface

The transverse abdominal island flap (TAIF) method of reconstructing the breast after mastectomy is a product of the thought and work of many individuals. The teaching philosophy of Dr. Maurice J. Jurkiewicz, Professor and Chairman of the Department of Plastic and Reconstructive Surgery at Emory University, has spawned a generation of enthusiastic, creative surgeons some of whose work had a direct bearing on the development and refinement of this technique. Over the past few years the investigative work of these men produced the concepts on which this operation is based.

In 1976 Arnold et al.[2] described a one-stage breast reconstruction after a radical mastectomy using the transposed greater omentum to cover a silicone prosthesis. In 1977 Schneider et al.[42] reported the first modern use of the latissimus dorsi musculocutaneous flap for a one-stage breast reconstruction. This operation has since been refined and popularized by Dr. John O. Bostwick.[4] His superior results and erudite presentations have been a major factor in the growing acceptance of breast reconstruction after mastectomy by both the medical profession and the general public. McCraw and co-workers[29] recognized the potential of the upper rectus abdominus musculocutaneous flap as an island when based on the superior epigastric artery. They believed it to be "the largest island myocutaneous flap in the body" and advocated its use for defects extending to the axilla, clavicle, and upper sternum. Brown et al.[6] demonstrated the importance and reliability of the perforators of the anterior rectus sheath in elevating, without a delay, transverse abdominal flaps that extended from the midline to the flank. In another important study, Hill and colleagues[20] demonstrated blood flow across the midline in a lumbosacral flap elevated on vascular perforators similar to those of the rectus abdominis. This confirmed the important concept that flaps can be nourished by blood flow originating on the contralateral side of the body. Mathes and Bostwick[24] and Nahai et al.[34] described the usefulness of the rectus muscle in the closure of abdominal and chest wall defects. Dr. T. Roderick Hester and colleagues[19] have given new insight into the abdominal wall blood supply which further substantiates the blood flow theory on which the design of the TAIF operation is based.

The concept that a large transverse abdominal island of tissue (isolated on the internal thoracic and the superior epigastric vessels) could be transferred to the chest wall and shaped into an autogenous breast crystallized into a plausible operation in 1979. The advantages of this method of breast reconstruction are: (a) the formation of a breast without the use of a silicone implant; (b) a one-stage operation that does not create

the "dog ear deformity" which results from a broad pedicle but provides the volume of tissue needed to fill even the most radical defects; and (c) a donor site on the abdomen where most women have tissue to spare and where a donor site scar is less objectionable.

In November 1979, patient B.B., 45 years old, presented with a Halsted radical mastectomy and a denervated latissimus dorsi muscle. This patient had excessive tissue on the abdomen, and it was her suggestion that this tissue be used to reconstruct her breast. At that time the recently formulated operation using the upper transverse abdominal island flap was described in detail to the patient with the clear understanding that she would be the pioneer patient for this operation. The concept and intricacies of the proposed procedure were then discussed with Drs. Paul W. Black and Michael Scheflan. After cadaver dissections and considerable thought, the operation was successfully performed on this patient on 9 September 1980. The first formal presentation of this procedure was in May 1981 to the American Association of Plastic Surgeons.

Each of our residents has contributed to the refinement of this operation, but the efforts of Drs. Michael Scheflan,[39] P.H. Beegle,[17] and L. Franklyn Elliott[12] deserve special mention. Although the TAIF operation is largely a product of the aforementioned investigators, the work and thought of others in this field[9,10,11,38] is fully recognized and appreciated.

This technique offers a promising way to reconstruct the breast, often with spectacular results. The operation is being performed successfully by a growing number of plastic surgeons throughout the world. The challenge now is to enable the qualified surgeon using this technique to consistently reproduce a pleasing breast shape without undue risk to the patient. The operation is demanding and involves considerable effort and skill in the areas of surgical judgment, operative technique, and artistic ability. The procedure is unforgiving of errors or omissions in any of these disciplines. In this videobook the critical details of the procedure are emphasized, and the opportunity to view this surgery and study the written text should be a valuable aid to the surgeon in successfully accomplishing the operation.

1

Anatomy of the Anterior Abdominal Wall

A Review of Structures Pertinent to the TAIF Procedure

Skin, Fat, and Investing Fascia

Skin

Unlike skin of the back, which is thick, the skin of the abdomen is relatively thin and compares well with skin of the normal breast. Although the skin of the abdomen is sometimes paler than chest skin, the color comparison is good. In some individuals there may be more hair on the skin of the abdomen than on the normal breast.

Fat

There is a heavy layer of fat between the skin and Scarpa's fascia in most individuals, and in women there is usually an additional infraumbilical fat deposit. This "tummy" was graphically depicted by Renaissance painters and is found to some degree in almost every female (Figure 1-1).

Investing Fascia

The deep layer of the superficial fascia (Scarpa's fascia) is a tough membranous sheet of yellow elastic fibers which covers the entire abdomen and adheres superiorly to the deep fascia at the fifth rib, laterally to the external oblique fascia, inferiorly to the inguinal ligament (or the fascia below), and in the midline to the linea alba. **This fascia is a strong tissue that aids in securely fixing the abdominal flap to the upper limits of the mastectomy defect on the chest wall.**

Supporting Structures of the Anterior Abdominal Wall

The intricate framework of the anterior abdominal wall is a beautiful demonstration of the inner working of static and dynamic structures which together effectively resist the force of the dead weight of the abdominal contents (Figure 1-2). Five paired muscles insert into and blend with ligamentous structures to form the basic support system (transversalis, internal oblique, external oblique, rectus abdominis, and pyramidalis). The key static vertical supporting structures are the linea alba and the two linea semilunaris ligaments extending from the ribs to the pubis. **These vertical supporting ligaments should always be preserved in their entirety when harvesting the vascular pedicle for the TAIF operation.**

The static transverse supporting structures include the anterior rectus sheath and the transverse tendinous inscriptions of the rectus abdominis muscle. The transverse inscriptions are firmly bound to the anterior rectus sheath, the linea alba, and the linea semilunaris. **The anterior rectus sheath and the transverse inscriptions are necessarily interrupted by the dissection of the**

Figure 1-1 Venus of Urbino—Titian c. 1538.

deep epigastric vascular pedicle in this operation. They should be carefully repaired in every case.

Another significant supporting structure of the lower abdominal wall is the muscle and tendon of the pyramidalis. This structure contributes additional support in the lower abdomen below the arcuate line where the posterior rectus sheath is absent. **Supporting structures below the arcuate line should be left undisturbed during the performance of the TAIF operation.**

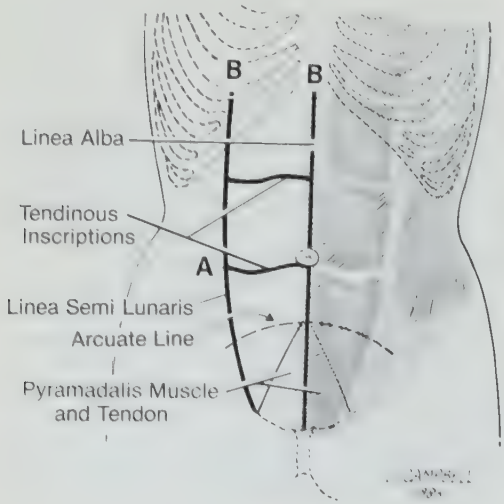


Figure 1-2 Ligamentous supporting structures of the anterior abdominal wall: transverse (*A*) and vertical (*B*). From Hartrampf[16].

Rectus Abdominis Muscle

The rectus muscle originates from the costal cartilage of the fifth, sixth, and seventh ribs. There is also a medial insertion to the costoxiphoid ligament and the xiphoid process. The muscle narrows below the umbilicus and becomes tendinous before it inserts into the pubis.

There are generally three dense tendinous inscriptions crossing the rectus muscle. The lowest inscription occurs near the umbilicus, and the other two are equally spaced in the upper half of the muscle.

The posterior rectus sheath provides some additional abdominal wall support. However, it is absent below a point approximately halfway between the umbilicus and the pubis (arcuate line). **Although the posterior rectus sheath is fairly**

strong above the umbilicus in most individuals, it can be attenuated in some cases and generally should not be relied on for lasting abdominal wall strength. Therefore the anterior rectus sheath should always be repaired after harvest of the rectus muscle.

Nerve Supply to the Anterior Abdominal Wall

Intercostal nerves 8 through 12 provide the sensory supply to the skin of the abdominal wall and innervate the anterior abdominal wall musculature. The iliohypogastric and ilioinguinal nerves supply the lower abdominal region near the inguinal ligament and the pubis, and should be avoided during the abdominal wall dissection and closure. The lateral segment of rectus muscle, which is left undisturbed during this operation, is innervated laterally and continues to function. The skin of the abdomen is, by necessity, denervated, although sensation returns to the abdominal wall within 6 to 12 months. The abdominal flap that is transferred to make the new breast should be insensate. However, after approximately a year patients describe perception of light touch and some sensation. The "sensation" can probably be explained by the transfer of pressure to the chest wall and by the ingrowth of nerves from the surrounding normal chest skin.

Blood Supply to the Anterior Abdominal Wall

The anterior abdominal wall is vascularized by the superior and inferior deep epigastric, the superficial inferior epigastric, and the eighth through the twelfth lateral intercostal vessels.

Superior Deep Epigastric Vasculature

The superior deep epigastric vessels are a continuation of the internal thoracic vessels. They enter the posterior rectus sheath beneath the cartilagenous confluence of the fifth, sixth, and seventh ribs. The course of these vessels from the rib margin to their entrance into the posterior aspect of the rectus muscle is variable (Figure 1-3). The most common finding is one or two large vessels that enter the central portion of the rectus muscle.

In approximately 10% of cases, the superior epigastric vessel courses along the costal margin giving off a large costomarginal vessel (Figure 1-3C). In these cases the superior epigastric vessels enter the muscle laterally at the junction of the lateral and central thirds of the rectus muscle.

Awareness of this anatomical variation is important. With preservation of a significant lateral segment of rectus muscle, this lateral position of the major vascular pedicle could lead to vessel injury during the muscle dissection near the rib margin. The eighth intercostal nerve should be divided in all cases to ensure atrophy of the rectus muscle in the epigastrium. However, in the rare instance when a major lateral vessel enters the rectus muscle with the eighth nerve at the rib margin, it may be prudent to preserve this vessel when dividing the nerve. If preservation of the large costomarginal vessel is found to restrict pedicle length, it should first be temporarily occluded to determine its contribution to the blood supply of the flap before it is divided.

Inferior Deep Epigastric Vessels

The inferior deep epigastric vessels are often larger than the superior deep epigastric vessels. The large artery is accompanied by two veins, and these vessels originate from the external iliac vessels immediately above the inguinal ligament and enter the posterior rectus sheath near the arcuate line. The inferior deep epigastric vessels are visible on the posterior aspect of the rectus muscle at the junction of the lateral and central thirds of the muscle. The artery most often continues as a single vessel but in approximately 15% of cases may form a double trunk. The vessels usually enter the muscle substance in the middle third of the rectus muscle.

Superficial Inferior Epigastric Vessels

The superficial inferior epigastric vessels are significant and originate from the femoral vessels just below the inguinal ligament. They enter the fat of the anterior abdominal wall at a point ap-

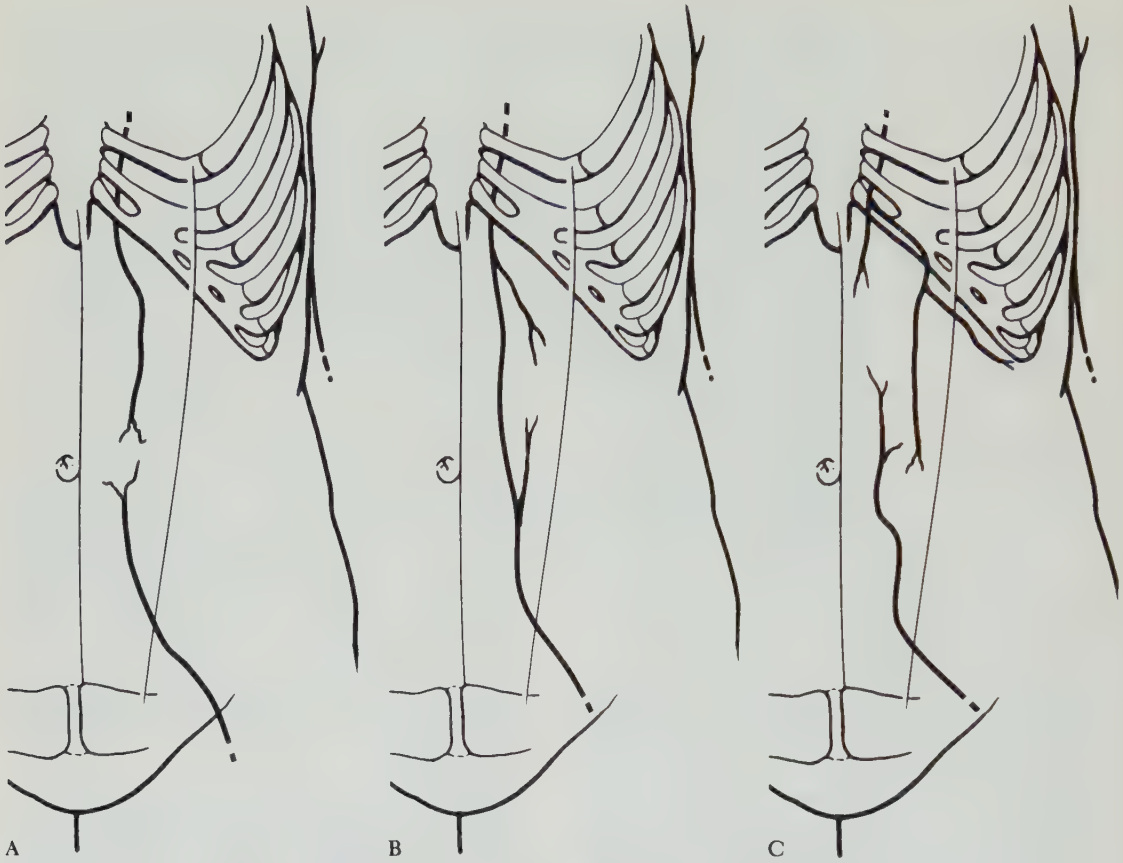


Figure 1-3 Deep epigastric arterial system (DEA). **A:** There is a single centrally located superior deep epigastric artery (SDEA) in 38.3% of patients and a lack of demonstrable communication between the superior and inferior systems in 60% (by cadaver dissection). **B:** There is a double trunk of SDEA in 53.3% of patients and direct communication between the superior and inferior systems in 40%. **C:** There is a single trunk of the SDEA along or under the rib margin with a large costomarginal "feeder" vessel in 10% of patients. From Milloy et al.[33]

proximately halfway between the pubic tubercle and the anterior iliac spine. They course over Scarpa's fascia, and higher up on the abdomen they assume a more medial and superficial position so that near the umbilicus they lie in the subdermal fat near the umbilical stalk.

The superficial inferior epigastric vessels play a significant role in the overall blood supply and venous drainage of the transverse abdominal island flap as they communicate freely across the midline with their counterparts and also intercommunicate with the inferior deep epigastric vessels.

Lateral Intercostal Vessels

The lateral intercostal vessels of varying size and number enter the lateral aspect of the rectus sheath and communicate with the deep epigastric vascular system. These vessels are necessarily divided during the isolation of the deep epigastric vascular pedicle.

In this operation these vessels nourish the preserved lateral segment of rectus muscle. The intercostal vessels can play a significant role in the distant transfer of abdominal tissue. The lower abdominal skin and fat can be transferred

to the chest based on the vascular perforators of the external oblique muscle.[23] It may be possible to transfer segments of the rectus muscle and overlying skin on these vessels alone.

Perforating Vessels of the Anterior Rectus Sheath

The perforating vessels of the anterior rectus sheath supply the skin and fat of the anterior abdominal wall and vary greatly in number, size, and distribution. The important anatomical fact is that the majority of these perforating vessels are located in the periumbilical region. (*Note:* These perforating vessels are called "perforators" throughout the rest of this book.) The following general statement can be made about the anterior rectus sheath perforators as determined from cadaver dissections and observations during surgery. There is a medial and a lateral row of periumbilical perforators (Figure 1-4). The lateral row can extend from the linea semilunaris rectus sheath to approximately the mid-rectus region and the medial row from near the medial rectus border to the mid-rectus region. They occur from approximately 2 cm above the umbilicus to 9 cm below it. The medial perforators are usually larger than the lateral ones, but there can be sizeable lateral perforators. There is a paucity of vascular perforators from approximately 9 cm below the umbilicus (the arcuate line) to the pubis and from 1 cm above the umbilicus to the epigastrium.

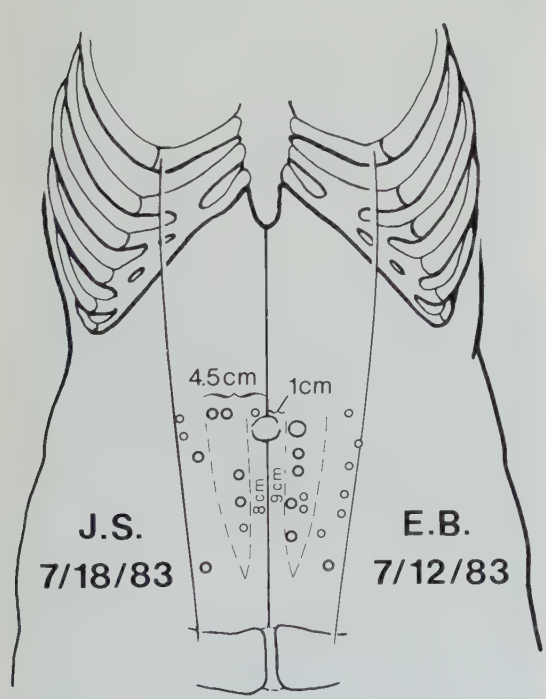


Figure 1-4 Vessels perforate the anterior rectus sheath, as documented in two patients (J.S. and E.B.). The size of the *circle* denotes the relative vessel size. Note the large vessels in the medial row from 1 cm above the umbilicus to 9 cm below it. The *broken line* represents the anterior rectus sheath and the rectus muscle harvest. Although the upper perforators were not precisely located, no significant perforating vessels occurred from 1 cm above the umbilicus to high in the epigastrium.

In view of the fact that the major vascular perforators of the anterior rectus sheath occur in the periumbilical region, it is important to include this portion of the anterior rectus sheath with both the lower transverse abdominal island flap and the upper transverse abdominal island flap.

It is a clinical impression that the large medial perforators originate from the superior deep epigastric system and the lateral perforators are more directly related to the inferior deep epigastric system. The lateral perforators that occur within the lateral 2.5 cm of the rectus sheath are of necessity sacrificed with the TAIF operation in order to preserve the lateral portion of the rectus muscle and sheath. Occasionally a small perforator is sacrificed if it occurs within the medial 1 cm of the preserved rectus sheath.

Vascular Territories of the Anterior Abdominal Wall

Each major vessel supplying the abdominal wall has a primary vascular territory.[29] However, in the living state the vascular territory supplied by one major vessel can be greatly expanded by interruption of the other major vessels supplying the surrounding tissues.[31] This becomes possible through a change in vascular pressure and flow in the "secondary territory" and occurs through direct vascular communication between territories. For example, the vascular territory of the superior deep epigastric system expands to cover virtually the entire abdomen when the inferior deep epigastric vessels and the superficial inferior

Figure 1-5 Internal thoracic arteriogram showing the superior deep epigastric system but no filling of the inferior deep epigastric system even with repeated injections under increased pressure

deep epigastric vessels and the intercostals are divided.

Hemodynamics

Meticulous cadaver dissections and arteriograms have failed to demonstrate a communication between the superior and the inferior deep epigastric vascular systems in more than 60% of the cases.[88] However, it is now known that a large lower abdominal ellipse can be safely transferred to the chest using only the superior epigastric vessels. There are several explanations for this phenomenon.

First, there is a direct communication between the superior and inferior epigastric systems in *every case*. Failure to demonstrate this in the living state (Figure 1-5) can be explained by intraarterial pressure gradients between the two systems that prevents flow from one artery into the other. Contrast material injected into the inferior deep epigastric system by direct cannulation of that vessel in most cases does not fill the superior

Figure 1-6 Arteriogram after direct cannulization of the inferior deep epigastric artery. The superior deep epigastric artery could not be filled from this route

Figure 1-7 This is the patient shown in Figure 1-6 after ligation of the inferior deep epigastric vessels. The internal thoracic arteriogram now shows filling of the entire deep epigastric arterial system down to the inferior vessel ligature.

Figure 1-8 Internal thoracic arteriogram showing direct communication as a single vessel. This occurs in only 18.3% of patients. From Milloy et al.[33]

epigastric system even with repeated injections under increased pressure (Figure 1-6). However, after the inferior epigastric vessels are ligated, an arteriogram performed through the internal thoracic artery reveals a direct flow between the two systems in an arborization of vessels around the umbilicus and complete filling of the entire inferior deep epigastric system (Figure 1-7). A single large communicating vessel (superior epigastric to inferior epigastric) can be demonstrated in less than 20% of the cases[33] (Figure 1-8).

It appears that the shift in flow direction is instantaneous with division of the inferior epigastric system, and that a preliminary "delay" by ligating the inferior epigastric vessels is unnecessary. The major periumbilical perforators supplying this lower abdominal flap are probably direct extensions of the superior deep epigastric system, and the surgeon should be aware that the perforators from the inferior deep epigastric system alone in some cases may be inadequate to carry the flap. Therefore it is important that the perforators lateral to and just above the umbilicus always be included with the lower TAIF to ensure a healthy flap.

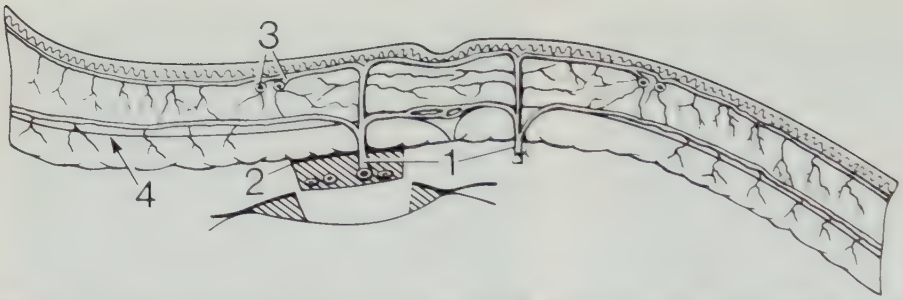


Figure 1-9 Cross section of a transverse abdominal flap just below the umbilicus. Note the relationship of the perforating vessels to the deep epigastric system (*1*), the anterior rectus sheath (*2*), the superficial inferior epigastric vessels (*3*), and Scarpa's fascia (*4*).

Intercommunication of Arterial Systems

The direct communication between the internal thoracic, the superior deep epigastric, and the inferior deep epigastric vessels can be utilized by interrupting the proximal end of the inferior deep epigastric vessel. Vascularized tissue can then be transferred from the lower abdomen to the chest and even to the head and neck. The combinations and possibilities for the use of this principle in the transfer of tissue about the body are unlimited. The importance of the communicating small vascular circles to the total viability of the transverse abdominal flap cannot be overly emphasized. The flow of blood from the deep epigastric system through the vascular perforators into the subdermal plexus and from there into the superficial inferior epigastric system (as well as the communication between these arteries across the midline) enhances total flap circulation when all of these vessels are preserved.

It is now known that the midline is not a barrier to the flow of blood. Hill et al.[20] demonstrated this very clearly with the transverse lumbosacral flap. This is also true with the transverse abdominal island flap; there is an active flow of blood from one side of the abdomen to the other through both the superficial epigastric system and the perforators from the deep epigastric system.

Blood Supply to the Skin and Fat of the Anterior Abdominal Wall

The major vascular perforators of the anterior rectus sheath extend directly to the subdermal region, where they form a rich vascular plexus (Figure 1-9). These vessels in the fat directly under the dermis communicate medially across the midline and laterally into the lateral reaches of the abdomen. There is also direct communication between this deep epigastric system and the superficial inferior epigastric vessels. The subdermal vascular plexus, reinforced by branches of the superficial inferior epigastric system, seems to play the dominant role in nourishment of the thick panniculus between the dermis and the fascia. Smaller branches of the perforators supply a vascular network above the level of the deep fascia and appear to communicate with the subdermal plexus.

These perifascial vessels are the basis for the fasciocutaneous flap described by Ponten.[37,44] This delicate vascular plexus in the areolar tissue just above the external oblique fascia should be elevated with the TAIF.

2

General Considerations

Preparation of the Surgeon

A sound surgical education and practical experience in both general and reconstructive surgery are basic to the successful performance of the transverse abdominal island flap operation for breast reconstruction. Additionally, the surgeon must be willing to embark on a rigorous surgical endeavor that requires substantial time for pre- and postoperative surgical management and an intense intraoperative effort that is uncommon in most plastic surgery operations performed today. The operation requires a significant commitment in the areas of surgical judgment (pre- and postoperative management), surgical technique (operative performance), and artistic skill (shaping the new breast). Armed with the willingness to tackle the problem, the surgeon should then undertake a refresher program consisting of an anatomical review (possibly cadaver dissections), didactic study, and actual observation of the surgery (live or video). This video book is designed to serve as an aid in preparing the surgeon for this operation.

Patient Selection

A physically healthy and mentally stable individual who does not evidence any major contraindications and has a strong desire for breast reconstruction with realistic expectations is the ideal patient for this transverse abdominal island flap operation (TAIF).

Patients in one or more of the following categories have a high incidence of complications and are not good candidates for the TAIF procedure.

1. The individual with a chronic illness (diabetes, uncontrolled hypertension, peripheral vascular disease, etc).
2. The emotionally disturbed individual (acute life crisis problems and/or chronic mental illness).
3. The obese individual.
4. The chronic heavy smoker.
5. The extremely thin individual.
6. Individuals with extensive abdominal scarring, which severely limits flap options or precludes adequate flap volume.
7. The patient who is a candidate for a less involved operation either by choice or by other limiting factors.
8. The poorly informed patient who expects a miracle.

Informing the Patient

During the initial visit, all available reconstructive options open to the patient should be carefully and realistically presented. Today's patient expects to be accurately and fully informed; a sam-

ple Patient Information Brochure is included with this text. The Patient Questionnaire which is completed at the initial examination, is helpful to the surgeon evaluating the patient and, along with photographs, is a good reference for subsequent surgical planning. It is both helpful and important to work with oncologists and the oncological surgeons in the timing of the reconstruction, analyzing the risk to the other breast, and evaluating the possibility of local recurrence and distant metastasis.

The patient must also have a clear understanding of the immediate and long-term postoperative healing time requirements. It is important to point out the locations of the scars that will result around the breast, the umbilicus, and on the abdomen. Showing the patient postoperative photographs of others who have had similar surgery is informative, and arranging conversations with patients who have already undergone the transverse abdominal island flap operation may be helpful.

Preoperative Preparation

Some deterrents to this procedure can be ameliorated when the patient is willing to commit herself to the resolution of the problem. Included in these conditions are obesity, extreme thinness, and possibly smoking. A willingness to invest this additional time and effort toward becoming a better candidate for surgery demonstrates a genuine desire for the operation. Such women are usually ideal patients.

It is probably helpful for patients who smoke to stop smoking at least 4 weeks prior to surgery. However, the chronic heavy smoker undoubtedly has small-vessel damage that is irreversible. This fact should be kept in mind when planning the surgery and appropriate steps taken to lessen the chances of complications (see Chapter 7). The patient should also be informed that (in our experience) the complication rate in heavy smokers is generally twice that in nonsmokers.

Two Weeks Before Surgery

Isoxsuprine (Vasodilan) 20 mg q.i.d. p.o. is administered for 2 weeks prior to surgery (13,14). The value of isoxsuprine in the human as a "chemical flap delay" is yet to be determined. However, a 2-week preoperative preparation with this medication has been used from the very beginning of our experience with this procedure, and our clinical impression is that it is of value in preventing tissue loss at the distant reaches of the flap. There have been no untoward effects observed with prolonged use of isoxsuprine. Occasionally, headaches or palpitation are experienced, but these side effects are self-limiting and have not prevented continuation of the 2-week regimen to completion.

The patient is given multivitamins with additional vitamin C (1g daily) for 2 weeks prior to surgery and is encouraged to keep physically fit. A preoperative program of situps and abdominal strengthening exercises may be helpful. General conditioning exercises (walking and jogging) are encouraged.

Recording Preoperative Patient Data

The following information should be recorded before surgery: circumferential measurements at the inframammary line, umbilicus, pubis, mid-humerus level on the arm, and mid-forearm; the patient's weight; and the location of abdominal, breast, and chest scars (see Patient Questionnaire).

Preoperative weight should be recorded along with a remark concerning abdominal wall strength. The number of situps the patient can perform with her legs bent, hands behind the head, and hands outstretched should be recorded. It is surprising how poorly some women perform this exercise, and it is important to record this preoperatively for a realistic postoperative evaluation.

Preoperative Planning

The evening before surgery, the chest and flap designs should be drawn on the patient in the standing position. (The **Markette** THINRITE MARKER has proved to be a good choice because it resists erasure during surgical preparation.) This planning visit gives the surgeon and patient another opportunity to discuss the procedure. Adequate time should be allowed for the patient's questions. Photographs should be taken after the markings are complete, again with the patient in the standing position.

Preoperative Orders

A mild preoperative medication is preferred so that the patient is alert in the operating room for conversation and, if necessary, the chest and abdominal markings can be reviewed with the patient standing or sitting. Adequate bowel decompression is important for a relaxed abdominal wall closure; therefore only liquids are permitted for 24 hours prior to surgery. On the evening before surgery, 30 cc of caster oil is given, followed by a cleansing enema the next morning. The following is an example of the physician's preoperative orders:

1. Liquid diet.
2. Have history and physical on chart prior to surgery.
3. CBC, SMA-20, urinalysis.
4. Preop ECG and chest X-ray.
5. Have patient shave both axillae and exposed pubis.
6. Vasodilan: 20 mg p.o. at 6 PM and 12 MN; 10 mg i.m. at 6 AM
7. Caster oil 30 cc H.S.
8. Dalmane 30 mg p.o. H.S. p.r.n.

9a. For unilateral reconstruction—type and crossmatch 2 units of packed cells.

9b. For bilateral reconstruction—type and crossmatch 4 units of packed cells.

10. NPO after 12 midnight.
11. Fleet's enema in AM.
12. Tagamet 300 mg p.o. H.S. and 1.5 hours before surgery with a sip of water.
13. Robinul 0.1 mg i.m. at 1 hour preop.

M.D.

Intraoperative Management

This operation is best performed by a team consisting of two surgeons, a scrub nurse, and two circulating nurses. The operating table is padded with foam rubber, and the patient is positioned with both arms at 90 degrees from the body with adequate padding of the arms. A two-point support of the arms at the wrist and at the elbow gives support to the arms when raising the patient to a sitting position during surgery. A Foley catheter is inserted in the bladder, and two pillows are placed under the knees. Other intraoperative considerations are as follows.

Anesthetic Management

Preoperative medications consist of the following:

1. Tagamet 300 mg p.o./1.5 hours preoperatively.
2. Valium 5 mg p.o. (all patients preferably) 1.5 hours preoperatively.
3. Robinul 0.1 to 0.2 mg i.m. 1.0 hour preoperatively.

Monitors and equipment needed are:

1. ECG: leads I, II, III.
2. Automatic blood pressure cuff (Dinamapp®)
3. Oxygen analyzer.
4. Temperature (Nasopharyngeal, oral, rectal, or with Foley).
5. Esophageal stethescope.
6. Fluid and blood warmer—all fluids.
7. Heated gas humidifier.
8. Foley catheter.
9. Central venous pressure (CVP), Swan, A-line as indicated.
10. Check arterial blood gases as needed.

Anesthetic technique includes the following:

1. Curare/Surital/Succinylcholine/Isoflurane/Pavulon.
2. Small OET. Oral endotracheal tube.
3. Controlled ventilation.
4. Standard neuromuscular reversal.
5. Maintain blood pressure within 20% of normal level.

Intraoperative Medications

1. Solumedrol 250 mg i.v. on induction and then 250 mg every hour to a maximum dose of 1 g intraoperatively.
2. Cephalosporin 1 g i.v. on induction then every 4 hr intraoperatively.
3. Narcotic of choice intraoperatively to prevent postoperative pain (fentanyl, etc.).
4. Droperidol 0.625 to 2.50 mg intraoperatively to prevent nausea.
5. Continue isoxsuprine 10 mg i.m. on a q 6 h schedule.

Fluid Management

1. Replace fluid deficit with dextrose 5% in lactated Ringer's solution (D_5LR).
2. Maintain fluids = lactated Ringer's solution.
3. Begin blood replacement with elevation of the flap and continue cc-for-cc replacement to avoid peripheral vasospasm.
4. Give Hetastarch supplement between blood replacements.
5. Maintain the final hematocrit at 35% or greater.
6. Anticipate continued blood loss from large wound surfaces—usually requires at least 2 units of blood intraoperatively for unilateral reconstruction and 4 units for bilateral reconstruction.

Warm the room for 30 min before the end of the surgery, and transfer the patient to her own hospital bed (not to a stretcher) with the head of the bed elevated 30 degrees and the knees flexed.

Recovery Room Care

1. Analgesia—morphine, 3 mg i.v. p.r.n.
2. Face shield oxygen 70%, with heating element for warm mist.
3. Warm postoperative fluids.
4. Hematocrit, hemoglobin, and SMA-6 in recovery room (minimum).
5. Measure the wound suction drainage every 30 min. Do not transfer the patient if it is excessive.
6. Monitor the breast flap continuously; do not transfer the patient if the flap is mottled and cold without definite signs of improvement.
7. Notify the surgeon if there is a mottled and unimproving flap or excessive wound drainage.

Postoperative Management in Hospital

Postoperative Orders

1. Vital sign intake and output q 4 h, I & O q 4 h.
2. NPO except for ice chips; advance to clear liquids in AM post nausea, then advance to a half-portion diet as tolerated.
3. Bed in semi-Fowler's position with the head of the bed up 30 degrees.
4. Out of bed in AM with assistance.
5. Foley to bedside drainage discontinued - D/C in AM.
6. Constant suction drains to bulb suction; drain and deflate q 4 h and record output.
7. Intravenous fluids.
8. Medications:
   a. Cephalosporin 1 g i.v. q 6 h.
   b. Cephalosporin 500 mg p.o. q.i.d. (when taking p.o.).
   c. Isoxsuprine 10 mg im. q 6 h discontinued when taking p.o.
   d. Isoxsuprine 20 mg p.o. q 6 h.
   e. Solumedrol 250 mg i.v. at 8 AM and 8 PM.
   f. Phenergan 25 mg i.m. q 4 h p.r.n. for nausea.
   g. Tylenol (650 but no more than 1300 mg) p.o. or suppository q 4 h p.r.n. for a temperature over 101°F.
   h. Multivitamins p.o. one a day.
   i. Dalmane 30 mg p.o. q H.S. p.r.n. for sleep.
   j. Laxative of choice.
   k. ASA p.o. b.i.d. when drains discontinued (not before 72 hours postop.)
9. Observe color and warmth of flap every 30 minutes. Call physician for mottling, changes in color, or coolness. Do this until 6 AM, then q 4 h.
10. Temperature probes, if used, should be read every hour. If there is a variation greater than 1.0°C, call the physician.
11. Postop hemoglobin and hematocrit in recovery room and at 6 AM.
12. No smoking sign on door.
13. Position patient with a unilateral reconstruction on her side with the new breast elevated. If color and warmth improve, change her position from back to side every 30 minutes.

M.D.

Monitoring the Flap

With proper patient selection, pre- and intraoperative planning, and postoperative management, there should be no loss of tissue. Monitoring of the flap begins during the operation and contin-

ues for at least 3 weeks. In the early postoperative period, the new breast will be paler and cooler than the surrounding tissue but should become warmer each hour. A flap that has a uniform white color and gradually warms is satisfactory. Temperature probes can be helpful in assessing this transition. If mottling of the flap occurs during the early postoperative course and is not relieved by repositioning and blood replacement, surgical reexploration is mandatory. The surgical techniques to relieve venous congestion in the flap are covered in detail in Chapter 7. An unhealthy flap should be recognized early in the postoperative course and corrective measures initiated immediately. If the flap does not show improvement within 6 hours postoperatively, immediate reexploration is mandatory. Every effort from the most basic maneuver to surgical reexploration should be utilized until the difficulty has been found and the problem resolved.

Postoperative Care

First Postoperative Day

1. Discontinue Foley catheter.
2. Clear liquids.
3. Discontinue (DC) i.v. after liquids are tolerated.
4. Up on side of bed in AM; in chair in PM.
5. With minimal breast drainage, DC breast drains.
6. Cough and deep breathe.

Second Postoperative Day

1. Out of bed to the bathroom and walk around room.
2. Advance diet to a regular diet (half-portions)
3. Abdominal drains are removed at the end of the second or the beginning of the third postoperative day.

Third Postoperative Day

1. Walking out of the room permitted.
2. Begin showers (after drain removal)

Fourth Postoperative Day Through Discharge

1. Begin ASA 10 gr b.i.d. or p.r.n. q 4 h. if drains have been removed and drainage or bleeding has stopped.
2. Sterile tapes on wounds should be left in place for 3 weeks. Wipe over skin adhesive tapes with peroxide p.r.n. to clean away bloody drainage. ***Do not remove*** skin adhesive tapes from wounds for 3 weeks. Clean umbilicus with peroxide as needed.

Management at Home

The average hospital stay is 5 to 7 days for unilateral or bilateral reconstruction. The patient is given the following instructions on postoperative self-management when discharged from the hospital.

Patient Guidelines

1. DO NOT remove skin tapes for 3 weeks.
2. DO NOT drive for 3 weeks.
3. DO NOT lift anything heavier than 5 pounds for the next 6 weeks.
4. DO NOT jog, bicycle, lift weights, or play tennis or golf for 6 weeks.
5. DO NOT raise your arms above shoulder level for 4 weeks.
6. DO NOT massage or exercise the breast for 3 weeks.
7. ABSOLUTELY NO SMOKING for 1 month. (It is also important not to be in a room with smokers.)
8. You may shower—be sure to pat the skin tape dry afterward.
9. You may take walks—this is good exercise for you.
10. You may begin swimming 4 weeks postoperatively.
11. You should cleanse your belly button with Q-tips and peroxide twice daily.
12. You may perform usual household duties after 3 weeks (if it is not strenuous and does not require lifting).

General Instructions

1. Continue Vasodilan (20 mg) four times a day for 3 weeks after surgery.
2. Take one aspirin two times a day for 3 weeks after surgery.
3. Weight control may be difficult immediately after surgery, but it is very important not to gain weight at this time.
4. It is only natural after a major operation for an emotional letdown to occur. If this happens, please call this office or your family phy-

sician for a prescription of Elavil (25 mg at bedtime). This should improve your spirits and allow a good night's rest. (Occasionally, a patient may not be able to take this medication because of drowsiness or other side effects. If these symptoms occur, discontinue use of the medication and call this office.)

5. Swelling and slight edema of your new breast and your abdomen is to be expected, and you may find that your clothes do not fit as easily as before. Be patient—the swelling will gradually subside and you will be back to normal within 3 to 6 months.
6. Because of the removal of tissue from your abdomen, a certain amount of tightness is to be expected. This will slowly relax within 2 to 3 months.
7. You may notice some vaginal burning and itching (vaginitis) as a result of the antibiotic used during and after surgery. If this is a problem, this office or your family physician can prescribe Mycostatin (vaginal application) to be used as directed.
8. Report to our office any changes in your breast or the incisions.

Routine Post-Hospital Course

One Week to three Weeks (Postoperative)

The skin tape adhesive remains in place, and the patient is encouraged to shower. Walking is encouraged, but no lifting is permitted. Vasodilan 20 mg q.i.d. is continued, and the patient is not permitted to wear a brassiere or to bind the breasts in any way.

Three Weeks to Six Weeks (Postoperative)

The skin adhesives tapes are removed, walking activity is increased, isoxuprine is discontinued, and weight control is emphasized. Sexual activity is permitted so long as the patient understands that abdominal healing and strength are not maximum for 6 weeks or longer and that the new breast should not be abused.

Six Weeks to Six Months (Postoperative)

A graduated conditioning program is encouraged, beginning with fast walking or slow jogging and progressing to preoperative exercise levels. Tennis and golf are permitted. The patient should be aware that postoperative weight gain is a common and difficult problem that must be confronted. Patients who gain weight postoperatively do not return to their preoperative well-being as rapidly as those who maintain a normal body weight. Also, the new breast (constructed from abdominal tissue) will increase in size disproportionately to the natural breast, creating an undesirable asymmetry. Problems that are of general concern to patients during this period of time include a loss of the normal "hourglass" waistline shape. It generally takes 6 months to a year for the normal waistline to return, and there is a prepubic fullness that is disturbing to the patient for a period of time. In addition, there is generalized abdominal discomfort marked by paresthesia in the midline of the abdomen, actual pain under the ribs, and a feeling of tightness in the abdominal area. Some of these symptoms can be relieved by antiinflammatory medication, but time is the best solution for this problem. During the recovery period, the patient needs continued encouragement and reassurance that weight control is important that general body condition will improve with time, and that she will achieve her preoperative state approximately 1 year after surgery. There may also be some areas of firmness in portions of the new breast. This represents an area of fat necrosis that will begin to resolve after 9 months and usually disappears within a year. The general surgeon and the oncologist should be made aware of this possible occurrence, and the patient should be so informed.

One Year Examination

At the end of 1 year, the follow-up examination should include postoperative photographs to match those views taken preoperatively. Circumferential measurements of the body—at the inframammary line, the umbilicus, the pubic region, the arm (on the mastectomy side), the mid-humerus, and the mid-forearm—and weight comparisons can then be made with the data recorded in the preoperative state (on the Patient Questionnaire). Testing the patient for abdominal strength can be accomplished by comparing her postoperative ability to perform situps with the number recorded preoperatively.

Questionnaire for Breast Reconstruction Patients

DATE:

BY:

NAME: MARITAL STATUS: S M D W

AGE HEIGHT (Approximate) WEIGHT (Approximate)

ADDRESS:

CHEST WALL DEFECT

	Right	Left	
Date:			Radical mastectomy
Date:			Modified radical mastectomy
Date:			Subcutaneous mastectomy
Date:			Implant or previous reconstruction
At Birth:			Congenital deformity
Date:			Other

PATHOLOGY: Number of positive nodes:

CHEMOTHERAPY? Date Completed

RADIATION? Date Completed

REMINDER: PLEASE FORWARD TO THIS OFFICE ALL PREVIOUS

- Pathology reports
- Operative reports
- Chemotherapy record
- Radiation treatment

GENERAL HEALTH: Diabetes? Hypertension? Other?

MEDICATIONS?

ABDOMINAL SCARS?

SMOKER? How Much? How Long? Will Patient Stop for Surgery?

HAS ANY FAMILY MEMBER HAD BREAST CANCER? (If so list relationship and age at onset)

ONCOLOGIST/INTERNIST (NAME & ADDRESS) SURGEON (NAME & ADDRESS)

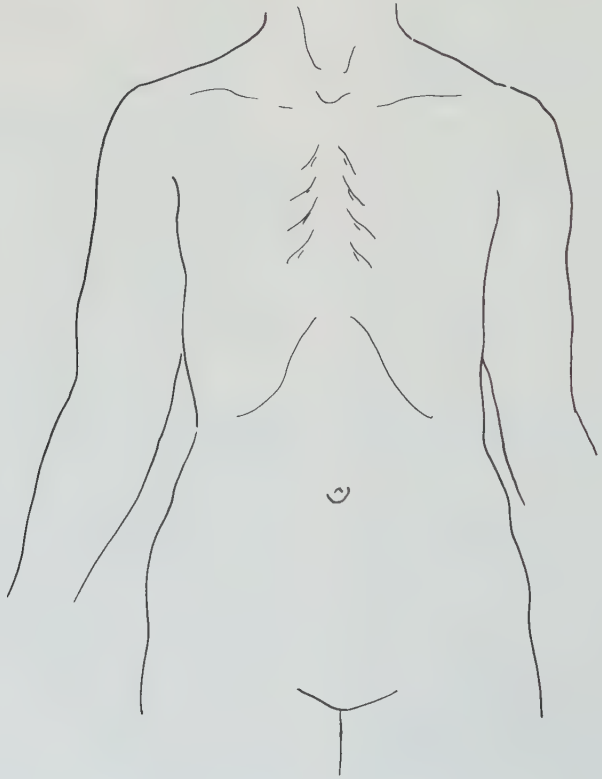
IS PATIENT'S REPORT TO BE MAILED TO HER PHYSICIAN? (If so list name and address)

SOURCE OF REFERRAL (M.D. OR OTHER)

COMMENTS:

Mark All Breast, Chest and Abdominal Scars

	Preop date	*One year postop date*
WEIGHT:		
NUMBER OF SITUPS:		
Hands behind head, knees bent, feet flat		
Hands toward feet, knees bent, feet flat		
CIRCUMFERENCE OF BODY AT:		
Inframammary line		
Umbilicus		
Pubis		
CIRCUMFERENCE OF ARM ON MASTECTOMY SIDE AT:		
Mid-humeral level		
Mid-forearm level		



3

Modified Radical Reconstruction

There are a number of reconstructive options available to women who have had a modified radical mastectomy. However, the spectacular results produced by the TAIF procedure may justify using this technique even though extra effort is demanded of the surgeon and a longer recuperative period is required of the patient. Although each patient's case is obviously unique, all modified radical reconstructions follow a similar pattern, so that a typical case described from beginning to end provides an excellent format for teaching the procedure.

Illustrative Case

A 40-year-old woman (Figure 3-1) had a left modified radical mastectomy at the age of 35; an attempt to reconstruct the breast at that time using a silicone implant failed. The lesion was a small intraductal carcinoma, and there were no positive axillary nodes. She received 1 year of chemotherapy. The patient is 5 feet 4 inches and weighs 120 pounds. After the usual preoperative evaluation, the procedure was discussed with the patient using the patient information material described in Chapter 2. The patient had a transverse mastectomy scar, a medium-sized right breast with slight ptosis, and a moderate amount of lower abdominal tissue. It was the patient's desire that the opposite breast be matched as closely as possible.

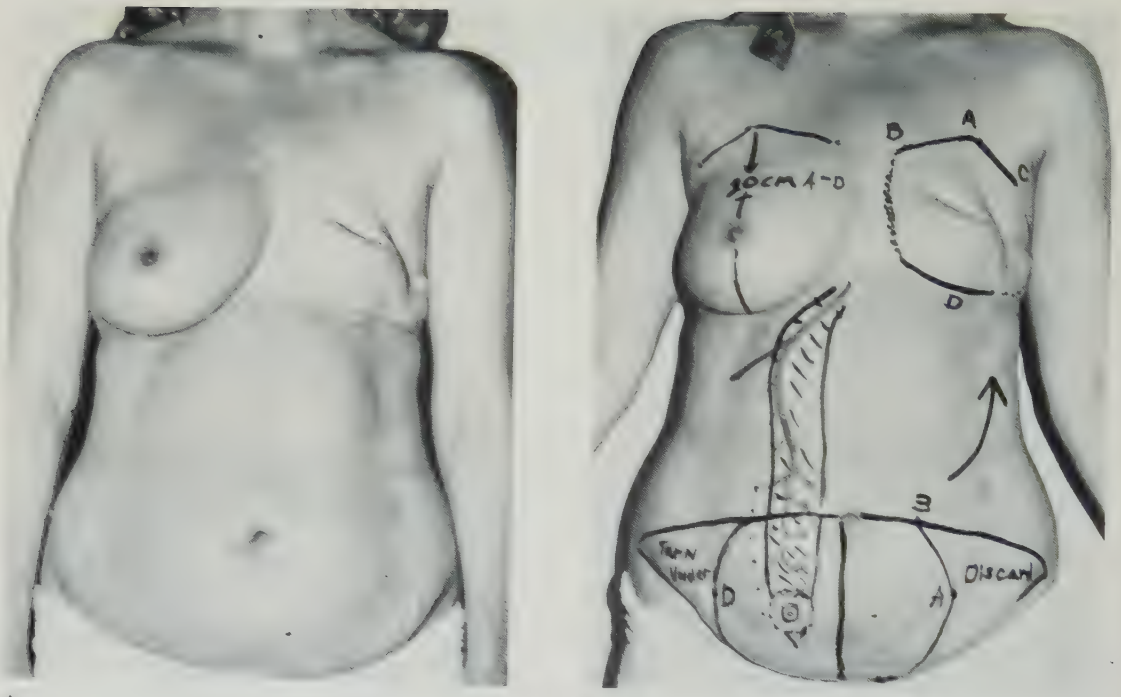
When using the transverse abdominal island flap technique, it is possible to match the large ptotic opposite breast (when desired) in a surprising number of cases, thereby eliminating most secondary procedures to alter the opposite breast. This may not be possible with other methods of breast reconstruction.

Preoperative Planning

Chest

The highest point of the mastectomy defect is marked on the chest as point A (Figure 3-2), the parasternal upper limit as point B, and the highest point on the anterior axillary fold as point C. An additional mark can be made at the highest point in the axilla when the axillary dissection has been extensive. This boundary of the upper limits of the mastectomy is now transposed and marked on the opposite chest wall. The inframammary line, point D, is marked on the mastectomy side using the opposite inframammary line as a guide.

The medial limit of tissue replacement is marked with a broken line, and the lateral limits of the new breast are estimated by comparison



A B

Figure 3-1 A: Patient with a modified radical mastectomy: illustrative case. B: Preoperative planning for a lower TAIF reconstruction using the contralateral vascular pedicle

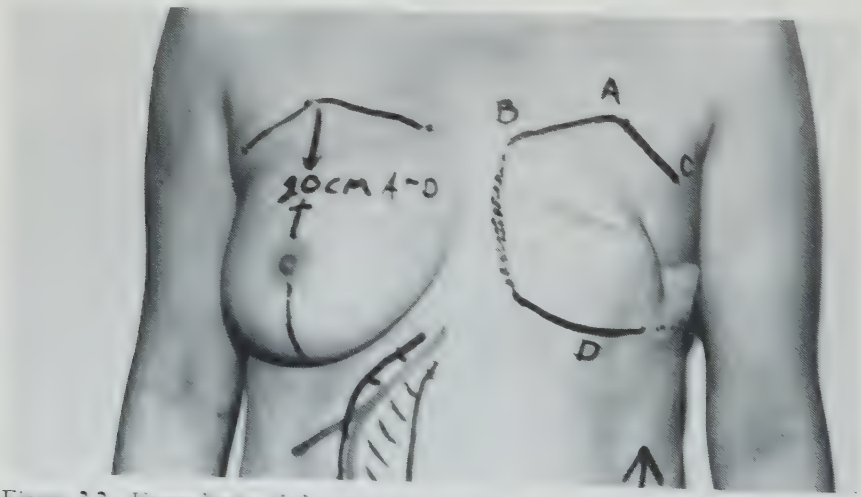


Figure 3-2 Upper limits of the mastectomy defect are marked by points *B*, *A*, and *C*, and the inframammary line is marked point *D*. *B*, *A*, and *C* are transposed to the normal side, and a line is drawn from *A* down over the nipple to *D*. This measurement represents the portion of the abdominal flap needed to reproduce the projection of the normal breast (in this case 20 cm.)

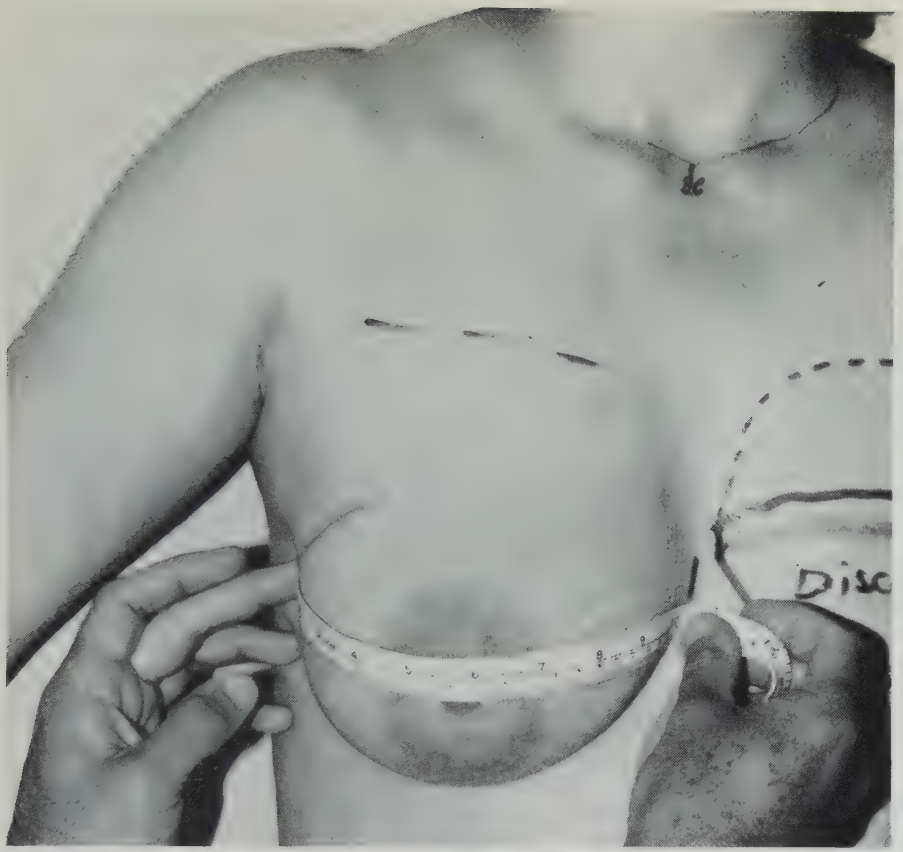


Figure 3-3 Transverse measurement of the normal breast gives the approximate width of the flap (demonstrated on a different patient).

with the opposite side. The lower lateral quadrant of the chest wall and the axilla should be carefully studied to determine the extent of the scarring that must be released to allow complete filling of the defect with autogenous tissue.

A measurement taken on the normal side (from a point corresponding to point A on the mastectomy side) down over the nipple to the inframammary line (point D) represents the portion of the abdominal flap required to reproduce the projection of the normal right breast. The remaining length of the flap from point D to the extreme tip will be turned under and used for additional bulk and projection if needed. The transverse measurement of the normal breast roughly corresponds to flap width requirements (Figure 3-3). However, in some cases it may not be possible to take enough flap width to exactly reproduce the desired breast width. Some of this discrepancy can be made up by turning the inferior wing of the flap into the lateral breast pocket (see "Shaping the New Breast," this chapter).

In this individual, the contralateral or right superior deep epigastric vessels are selected as the pedicle. **The choice of an ipsilateral or contralateral pedicle side is based on a number of factors (abdominal scarring, etc.; see Chapter 6). The surgeon should have experience with the use of either side and make the selection that best suits the patient (Figure 3-4). In this individual (and in most situations where the abdomen is unscarred and there is a moderate amount of abdominal tissue available) the contralateral pedicle is the best choice for two reasons. First, with the use of the contralateral pedicle and a 90-degree rotation of the flap on the chest (counterclockwise for the left breast and clockwise for the right breast), the unreliable**

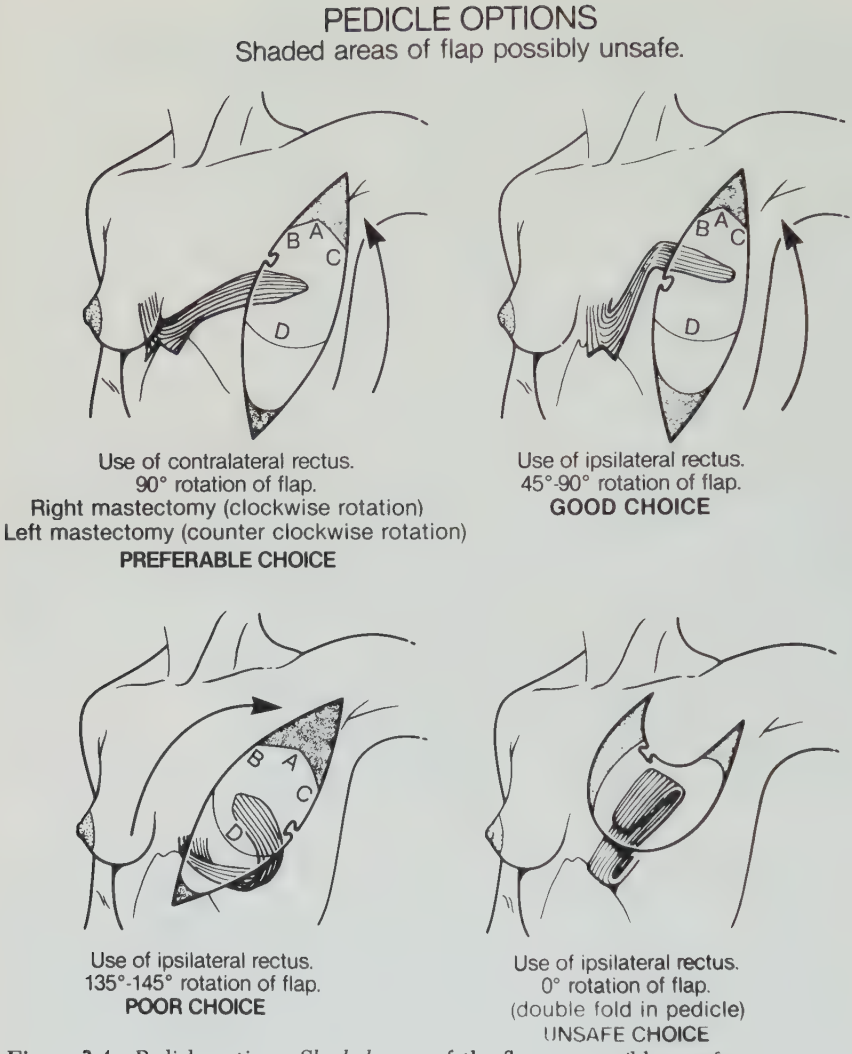


Figure 3-4 Pedicle options. *Shaded areas* of the flap are possibly unsafe.

portion of the flap (the least vascular) can be discarded. This maneuver puts the well-vascularized tissue that lies over the pedicle in the ideal location to produce the new breast. Second, with the transfer of the abdominal flap to the chest and its rotation of 90 degrees, the vascular pedicle rests in the tunnel in a flat unrestricted manner with only a slight twist at the rib margin. This facilitates the ***all-important venous return*** from the flap. The lower transverse abdominal island flap is generally the flap of choice and was selected in this patient because she is a young, healthy female who would obtain the added benefit of an abdominoplasty with a donor site scar on the lower abdomen (Figure 3-1A). Faced with a different set of circumstances, e.g., severe abdominal scarring, the surgeon should not hesitate to vary the design of the flap on the abdomen or to move the flap higher on the abdomen (see Chapter 6).

Abdomen

The upper limit of the abdominal flap is drawn from a point beginning at the upper limit of the umbilicus and extending laterally to a point

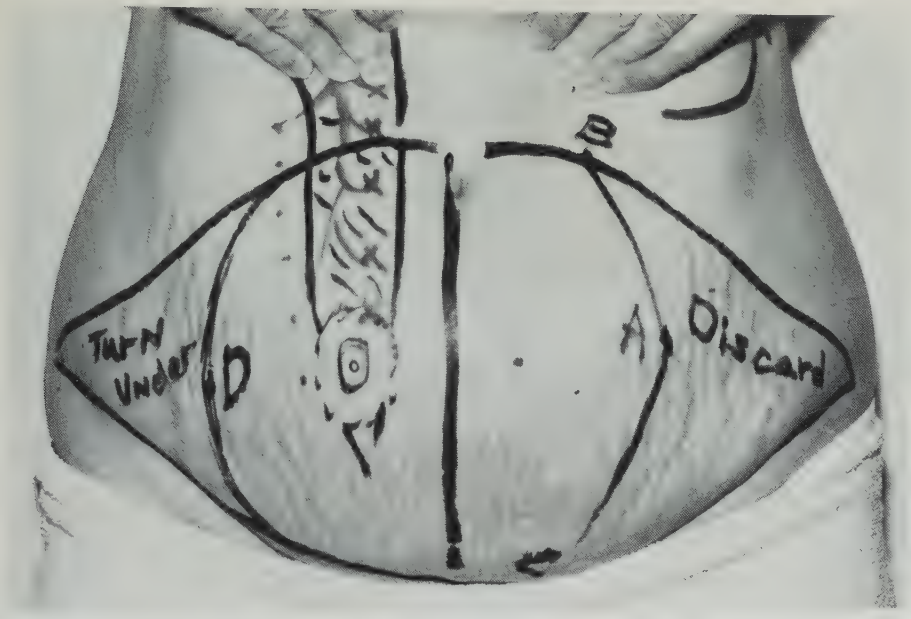


Figure 3-5 Vertical midline mark drawn on the abdominal flap represents the mastectomy scar. Points *B, A,* and *C* represent the upper limits of the breast replacement. Point *D* represents the inframammary crease. Note that the location of the future nipple lies over the vascular pedicle.

lateral to and below the anterior iliac spine (as with a standard abdominoplasty) (Figure 3-5). The inferior limit of the flap is drawn from the suprapubic crease laterally to meet the upper line previously drawn. With this flap design, the critical periumbilical perforators are included with the flap and enough tissue is gained to make an adequate breast and at the same time allow for tight but good abdominal skin closure.

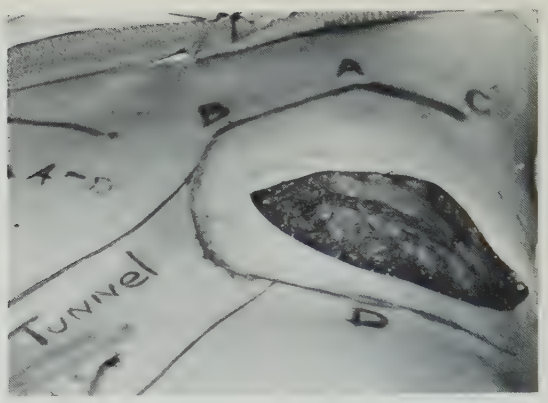
The width of this patient's abdominal flap is 15 cm (14 to 15 cm is the average). The location of the excised mastectomy scar will be the location of the suture line on the new breast, and this line is drawn vertically across the flap slightly past the midline on the pedicle side. The distance from the mastectomy scar to point A is transferred to the abdominal flap. Points B and C are marked on the flap using the mastectomy scar and the transverse line on the flap as reference points. The tissue from points A, B, and C to the left tip of this flap has the poorest blood supply, is not needed in this case, and will be discarded. The distance from point A to the nipple on the existing breast gives the approximate location of the new nipple (to be reconstructed at a later date) on the new breast. Note that this lies directly over the vascular pedicle. Point D is marked 20 cm to the right of point A on the flap; this indicates the approximate location of the inframammary line on the new breast. The tissue from point D to the right flank will be deepithelialized and turned under for added bulk and projection in the new breast.

When less ptosis is desired point D is moved medially, and when more ptosis is wanted point D is moved laterally. When less bulk is the aim, the tissue from point D to the tip of the flap is trimmed to achieve the desired size. If more bulk is needed, this tissue is retained and turned under the new breast to increase volume and projection.

Surgical Procedure

Preparing the Chest

The mastectomy scar is excised and preserved for microscopic study, and an ellipse of skin below the scar to the new inframammary line is discarded (Figure 3-6). It is difficult to determine



A B

Figure 3-6 A, B: The mastectomy scar is excised, and an ellipse of skin is taken with it from below the scar to just above the inframammary line.

the exact inframammary line at this point. Therefore a conservative excision is performed at this stage, and more skin can be excised in this area during the final shaping of the breast if necessary.

Excising this normal chest skin below the mastectomy scar is contrary to the old dictum in reconstructive surgery of never discarding good tissue. However, in this operation it is important to allow the breast to protrude from the chest in a normal fashion. In this manner the abundance of abdominal skin is utilized to give a natural looking breast with ptosis and projection but without tightness of the skin. This maneuver also serves to decompress the flap postoperatively in that the new breast will expand outward with edema and the skin will continue to be loose without compromising venous return. It must be kept in mind that this abdominal flap will not tolerate pressure on the pedicle or the newly formed breast, and there should be no tension on the suture line when sewing the flap into the chest wall. Another advantage of discarding the normal skin below the mastectomy scar is that the new breast will have only one transverse scar across the top of the breast (which of course is visible) and the remaining scar will be hidden in the inframammary crease.

The chest skin is elevated with only a minimum amount of subdermal fat so that there will be no discrepancy in the level of the chest skin and the new breast (Figure 3-7). At points A, B, and C in Figure 3-7, across the upper limits of the mastectomy defect, the dissection is carried down to the pectoralis major fascia to which the upper limits of the flap will be sutured. All limiting scar in the anterior axillary fold area C and any scarring lateral to that in the axilla is released. This usually includes freeing the chest skin to the lateral limits of the mastectomy scar. Again, this dissection should be in a superficial (subdermal) plane to facilitate release of this scar and at the same avoid damage to vital nerves and vessels in the axilla.

Releasing axillary contracture and chest skin tightness and filling this space with normal fat provides one of the secondary benefits of this TAIF operation. Patients comment after surgery about relief from numbness in the axilla and the arm and freedom from tightness in the axilla and the chest.

The dissection is carried inferiorly to the inframammary line but not below point D. This inframammary line will be pulled downward by release of the chest wall scar and eventual closing of the abdominal wound.

The tunnel for the passage of the abdominal flap is made in the epigastric area and under the opposite breast (Figure 3-8). Note that the inframammary line at point D is not disturbed.

The natural inframammary adhesion serves as a shelf on which the new breast and its pedicle

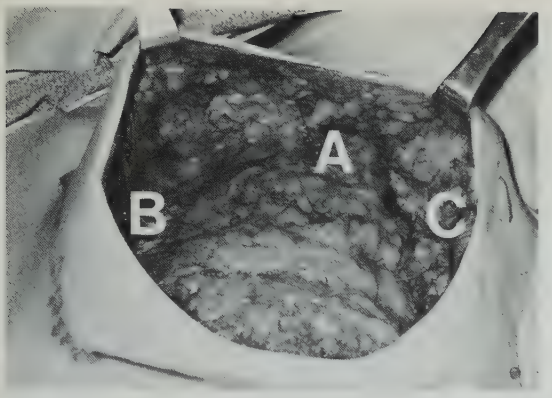


Figure 3-7 The chest skin is elevated to the limits of the mastectomy defect.

will rest. Unnecessary dissection in the region of the inframammary crease allows fat from the new breast to herniate below this line and causes an undesirable loss of definition in the inframammary area. If the inframammary line is destroyed, it is difficult to repair. If it is inadvertently opened, attempts to repair this area may be unsuccessful and the repair could impinge on the vascular pedicle and obstruct venous return.

Elevation of the Abdominal Flap

The incision across the upper limit of the flap is angled away from the skin incision and beveled toward the epigastrium in order to include the important perforators. In the thin individual who has only a small amount of abdominal tissue, this angled incision allows additional fat to be included with the flap. The dissection is continued into the epigastrium to meet the tunnel previously made under the right breast.

The anterior rectus sheath is incised from above the fifth rib to the upper limit of the flap with a medial and lateral incision (Figure 3-9). The incision closest to the midline is made approximately 1 cm to the right of the medial border of the rectus. The lateral incision begins at

Figure 3-8 The tunnel is dissected from the mastectomy pocket through the epigastrium to the contralateral pedicle. Note that the inframammary area of the mastectomy side is not disturbed.

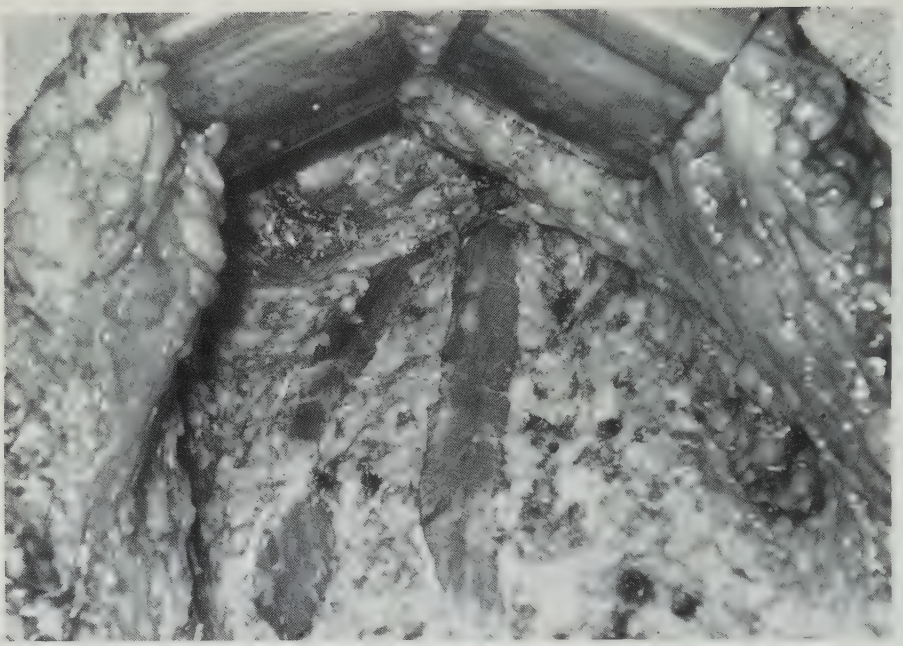


Figure 3-9 The upper abdomen is exposed, showing the medial and lateral incisions in the anterior rectus sheath. The incisions begin at the origin of the anterior sheath over the fifth rib.

the same point over the fifth rib and is extended obliquely downward over the confluence of the sixth and seventh ribs to a point approximately 2.5 cm from the lateral rectus border (Figure 3-10). The sheath incision is then continued with this 2.5-cm margin to the upper limit of the flap.

The lower limit of the abdominal flap is opened by beveling the skin incision toward the pubis to include more fat when necessary. As the superficial inferior epigastric vessels are encountered, they are controlled by vascular clips.

The left side of the abdominal flap is elevated to the lateral border of the left rectus muscle. This elevation is performed in a plane on the external oblique fascia, and it is important to include the loose areolar tissue directly above the fascia (containing the perifascial vascular plexus) with the abdominal flap (see Chapter 1).

The dissection of the left side of the flap is continued to just past the midline. The location and relative size of the vascular perforators of the anterior rectus sheath should be noted as they are encountered and used as a reference when elevating the pedicle side of the flap (Figure

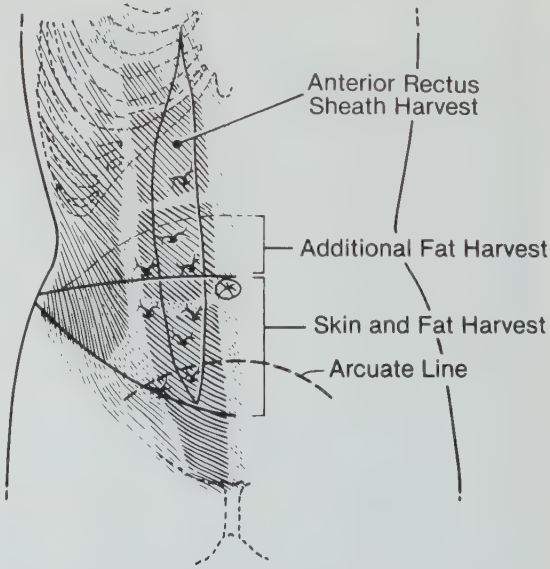


Figure 3-10 Anterior rectus sheath harvest and location of the periumbilical perforators. Note the relationship of these structures to the transverse abdominal flap and the additional fat harvest above the umbilicus.

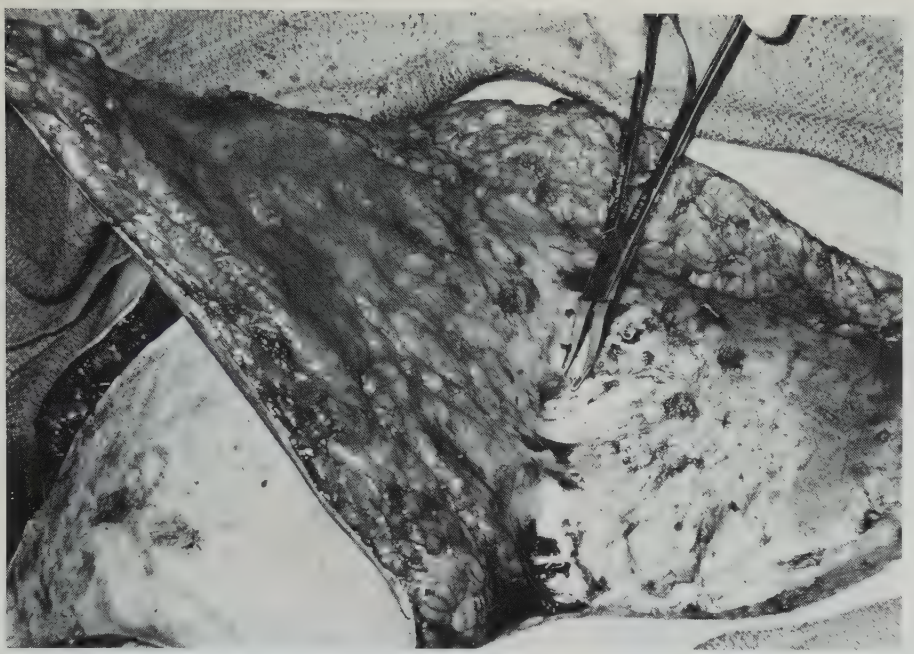


Figure 3-11 Elevation of the nonpedicle (left) side of the flap showing the location of the vascular perforators, which are noted and used as a reference when elevating the pedicle side of the flap.

3-11). **The location and size of these vascular perforators is highly variable (see Chapter 1), but the important point to remember is that they are concentrated in the periumbilical region.**

The medial anterior rectus sheath incision is continued from the upper limit of the flap (Figure 3-10) to a point approximately midway between the umbilicus and the pubis (the arcuate line). At least a 1-cm cuff of anterior rectus sheath is left undisturbed. The rectus muscle is incised from above the tendinous inscription near the umbilicus to the arcuate line level, and the muscle fibers are separated to the posterior rectus sheath (Figure 3-12). A rudimentary umbilical artery and vein, encountered on the posterior rectus sheath near the umbilicus, can be safely sacrificed. In some cases this umbilical vessel gives off an anterior rectus sheath perforator within the preserved medial 1 cm of the sheath, and this can also be sacrificed without harm to the flap.

The right side of the abdominal flap is elevated to the lateral border of the rectus muscle. Again the vascular areolar tissues just above the external oblique fascia are included with the flap. The lateral line of the rectus perforators is encountered at the rectus border (Figure 1-4); these are by necessity divided and controlled with vascular clips. As the dissection continues, the field should be free of blood and well lighted for clear vision during this phase of the operation. The large medial row of perforators are visualized as they penetrate the anterior rectus sheath. Just lateral to these perforators, the anterior rectus sheath is incised to a point which joins the medial incision below (near the arcuate line). At least a 2.5-cm strip of lateral rectus sheath is preserved (Figure 3-13).

The rectus abdominis muscle is incised just lateral to these large perforators, and the muscle fibers are carefully separated to expose the posterior rectus sheath. As the lateral intercostal vessels and nerves are encountered, they are controlled with vascular clips and divided (Figure 3-14). The large deep inferior epigastric vessels are encountered at the level of the arcuate line and are controlled with three large vascular clips and divided (Figure 3-15).

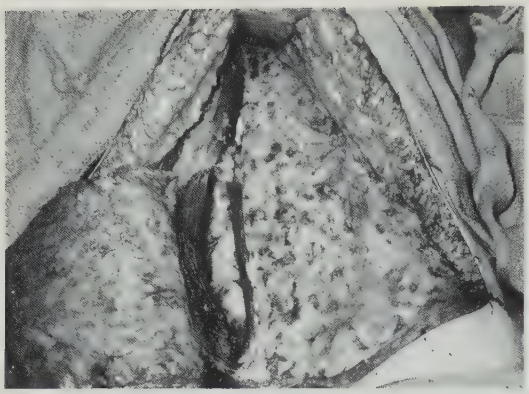


Figure 3-12 Flap elevated from the nonpedicle side, showing rectus muscle incised from above the tendinous inscriptions near the umbilicus to the arcuate line with separation of the muscle bundles to expose the posterior rectus sheath.

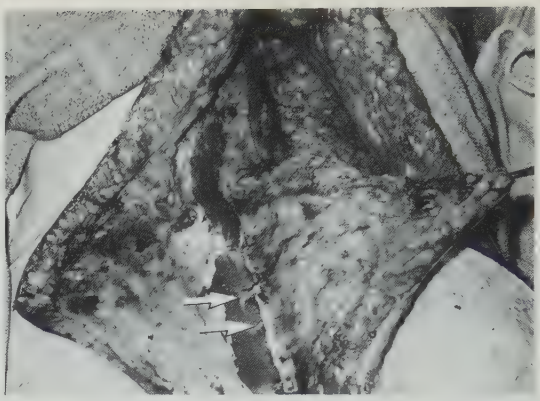


Figure 3-13 Flap elevated on the pedicle side with a lateral incision in the anterior rectus sheath showing the medial row of vascular perforators (*arrows*) as they enter the rectus sheath.

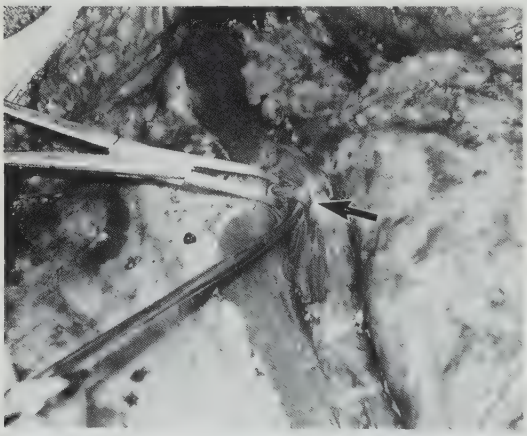


Figure 3-14 The rectus muscle bundles are separated lateral to the large vascular perforators. The lateral intercostal vessels and nerves (*arrow*) are controlled with vascular clips and divided. A strip of lateral rectus muscle at least 2.5 cm wide is preserved.

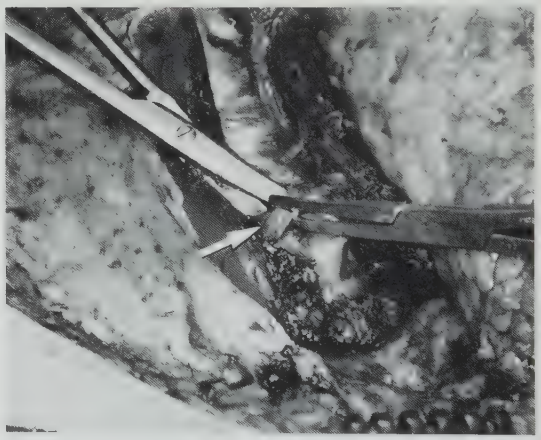


Figure 3-15 The deep inferior epigastric vessels (*arrow*) are divided as they enter the posterior rectus sheath near the arcuate line.

Preservation of a strip of innervated lateral rectus abdominis muscle is important to the postoperative soundness of the abdominal wall. This muscle-preserving dissection is safe if all vessels within the muscle and on the posterior sheath are identified before they are divided so that vertical running branches of the deep epigastric vascular system are not damaged.

The inferior deep epigastric vessels are controlled, and the muscle separation continues in a cephalad direction. Small vessels running laterally are controlled with small vascular clips and divided as they are encountered in the muscle. There will be brisk bleeding at each tendinous incription. Small oozers in the muscle usually stop bleeding spontaneously. Use of cautery on the

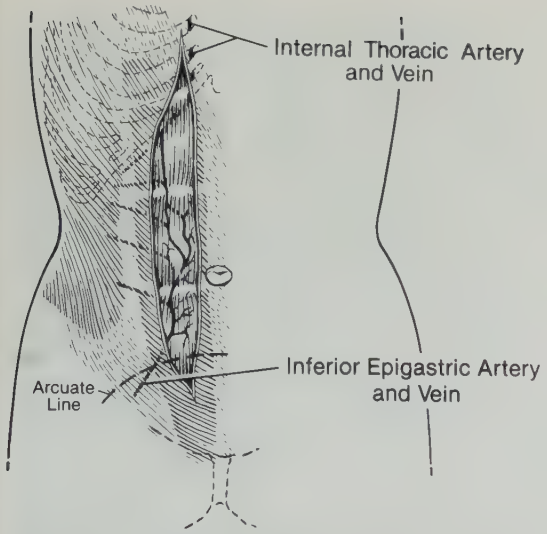


Figure 3-16 The deep epigastric vessels are shown in relation to the rectus muscle harvest.

muscle and around the pedicle should be avoided. If a significant vessel is discovered running in a vertical direction, the dissection should be continued on the lateral side of that vessel until its identity is determined. If it is a lateral intercostal vessel it should be divided, but if this vessel is discovered to be an arborization of the deep epigastric system it should be preserved and swept medially to be taken up with the vascular pedicle. The major deep epigastric vessels occur in the posterior aspect of the central third of the rectus muscle (Figure 3-16).

This intramuscular dissection is continued toward the rib margin (Figure 3-17) to a point over the seventh rib. At this supracostal margin location, the rectus muscle fibers are divided on top of the seventh rib in a medial direction in order to narrow the muscle pedicle. This, in effect, leaves approximately one-fourth of the muscle pedicle attached to the seventh rib near the xiphoid.

This dissection must be carried out above and on top of the rib to avoid injury to the vascular pedicle below the rib. The rectus muscle is now retracted medially, and the dissection is carried downward over the rib margin to carefully expose the eighth intercostal nerve and the costomarginal artery and vein (Figure 3-18).

A word of caution: **In some cases the costomarginal artery is quite large and the deep superior epigastric vessel originates from this vessel**

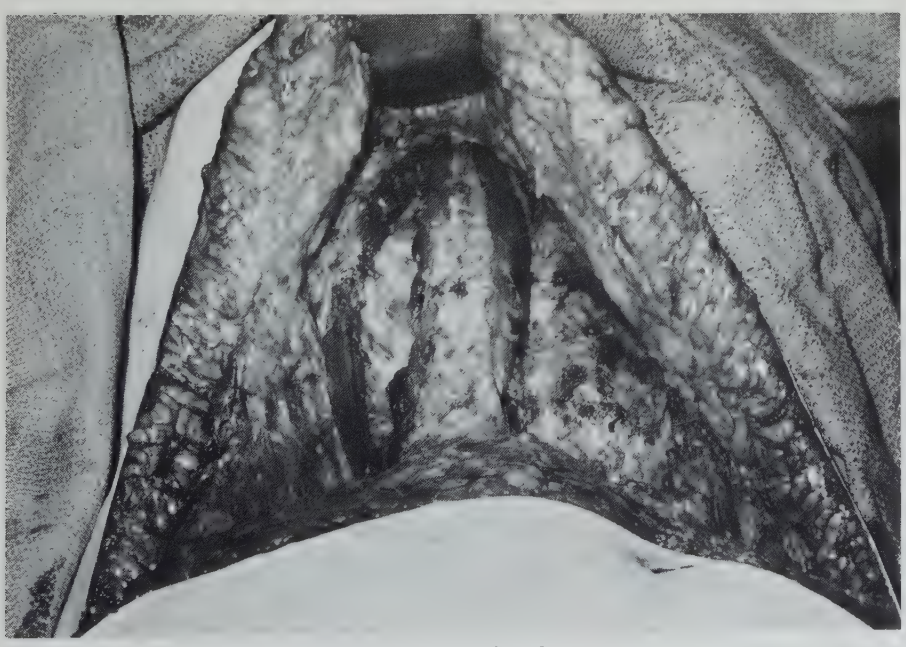


Figure 3-17 The rectus muscle is dissected to the rib margin.

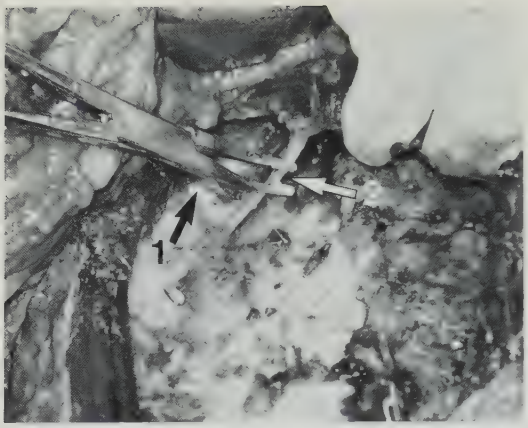


Figure 3-18 The rectus muscle fibers are divided on top of the seventh rib (*arrow 1*) in a medial direction to narrow the muscle pedicle. The muscle is retracted medially to expose the eighth intercostal nerve and the costomarginal vessels (*arrow 2*).

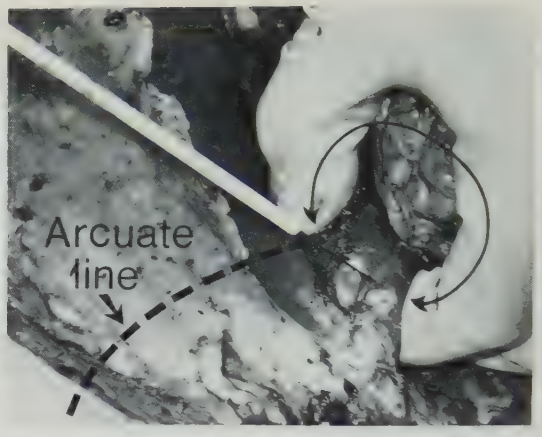
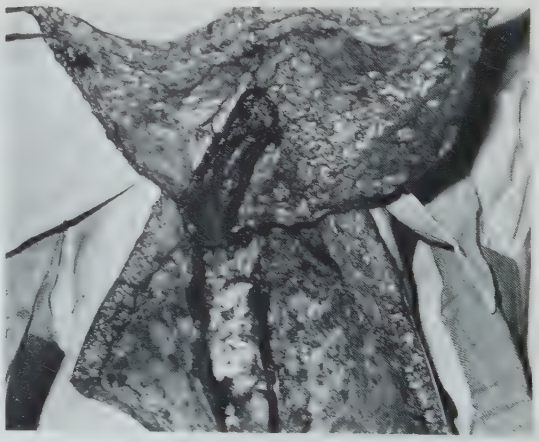


Figure 3-19 The central third of the rectus muscle (indicated by *curved arrows*) is divided at the arcuate line.

in a lateral position. This infrequent variation (approximately 10%) could lead to damage of the major vascular pedicle during this stage of the dissection. By performing this muscle dissection from a caudad to a cephalad direction and by retracting the preserved muscle pedicle medially, this critical subcostal area is given adequate exposure for more precise identification of the important vessels and nerves. The eighth intercostal nerve should always be sacrificed to ensure atrophy of the rectus muscle in the epigastric tunnel. The costomarginal vessel should be clearly exposed and divided far laterally to avoid kinking and damaging the major pedicle. In the event that an unusually large costomarginal or lateral vessel is encountered, it might be prudent to temporarily occlude this vessel to determine its influence on the flap before it is divided.

The central third of the rectus muscle is divided at the arcuate line (Figure 3-19). The pedicle portion of the rectus muscle is dissected from

A



B

Figure 3-20 A, B: The elevated flap is now attached only by the musculovascular pedicle.

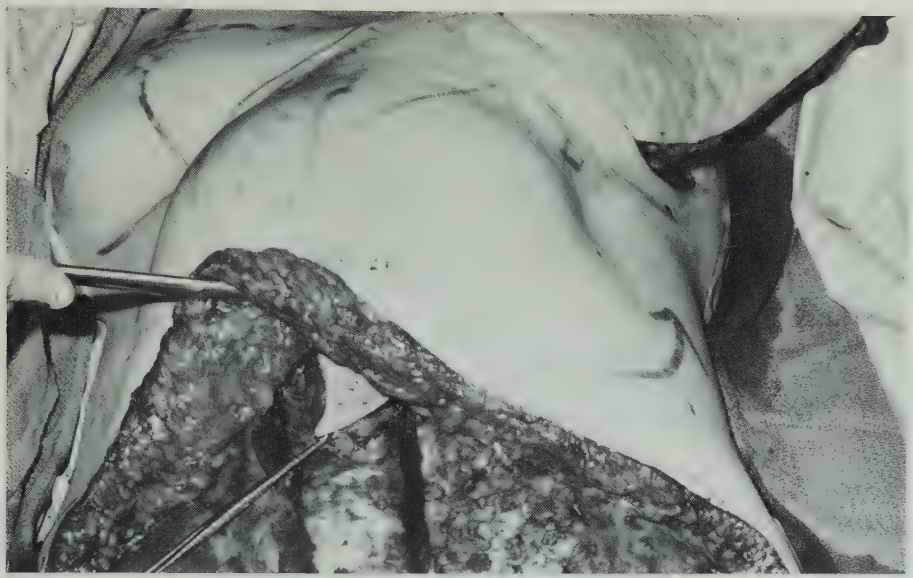
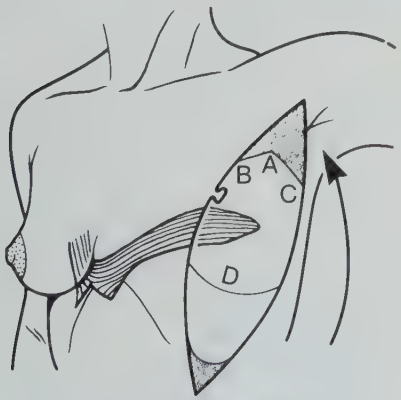


Figure 3-21 The abdominal flap is passed through the tunnel into the breast pocket (left tip first).

the posterior rectus sheath to the xiphoid process. The lower abdominal flap is now free except for a pedicle containing the deep superior epigastric artery and vein and a small segment of the rectus muscle (one-third to one-fourth of the muscle width) (Figure 3-20).



Use of contralateral rectus.
90° rotation of flap.
Right mastectomy (clockwise rotation)
Left mastectomy (counter clockwise rotation)
PREFERABLE CHOICE

Figure 3-22 The flap rotation used in this patient.

The abdominal flap is passed through the tunnel into the chest pocket (Figure 3-21). The left side of the flap is placed in a cephalad position toward the axilla (Figure 3-22). Temporary staple fixation of the abdominal flap at the umbilical level to the medial point of the mastectomy scar is helpful in holding the large flap on the chest while the abdomen is closed (Figure 3-23).

The abdominal wall closure usually takes place at this stage of the operation. However, for the sake of continuity in the discussion, we proceed with shaping the breast.

It is important to close the abdominal skin, at least temporarily, before the breast is shaped in order to determine the exact level of the inframammary crease on the reconstructed side.

Shaping the New Breast

Shaping this large amorphous mass of abdominal skin and fat into a realistic looking breast is a challenge. Achieving this goal is critical to the total success of this operation. The time spent in this area of endeavor is directly reflected in the beauty of the final product.

When shaping this winged flap to form a breast that has good proportion and projection,

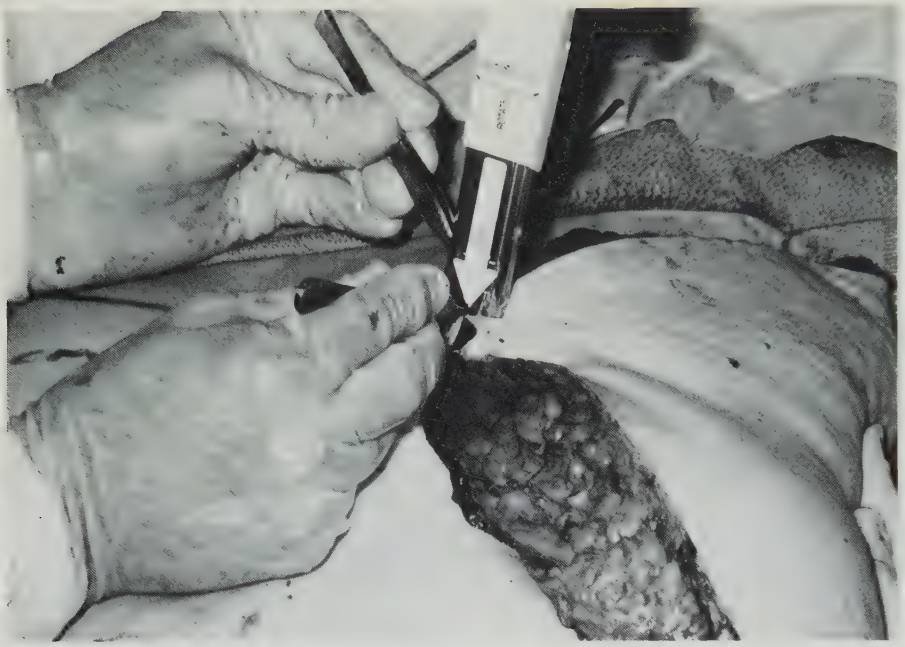


Figure 3-23 The umbilical point on the abdominal flap is stapled to the medial point of the mastectomy scar.

it seems reasonable to fold the two ends toward the middle to form a thick central mass that would hopefully give a natural appearing breast. However, a breast so constructed has too much bulk medially and a deficiency of tissue laterally. There is also too much volume high on the chest wall (Figure 3-24). The volume requirements for a normal breast (the radical mastectomy defect is an exception) are greatest in the lower outer quadrant and least in the upper inner quadrant (Figure 3-25). With flap safety in mind this volume distribution can be pro-

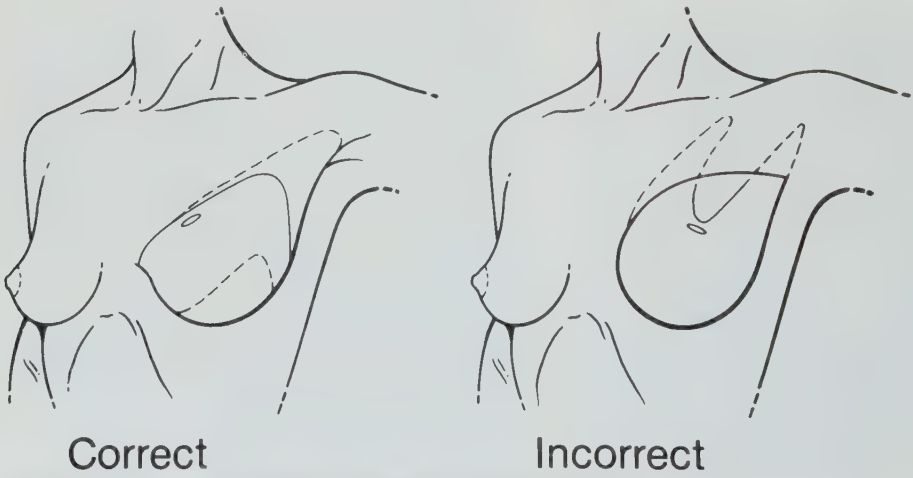


Figure 3-24 Method of folding the flap to produce the breast shape and projection.

Figure 3-25 Volume requirement for the normal breast. The greatest volume is required in the lower outer quadrant and the least in the upper inner quadrant.

duced by rotating the flap 90 degrees to a plane paralleling the long axis of the body and then folding the inferior wing into the lower outer quadrant to create bulk and projection.

After the abdominal flap has been rotated 90 degrees (in this case in a counterclockwise direction) and fixed medially at a central point (Figure 3-26), the shaping process can begin. This medial fixation point serves as a fulcrum for trimming the flap and working the inferior wing laterally to give bulk and projection in the lower outer quadrant.

The upper portion of the flap that extends beyond the mastectomy defect (line BAC in Figure 3-27) is trimmed away. The flap skin is incised transversely at the line previously drawn to correspond with the mastectomy scar. From this transverse incision on the flap to points B, A, and C, the epithelium is removed leaving a dermal bed. The flap is turned over on the chest and the underside trimmed and tapered to a thin edge at BAC (Figure 3-28). This tapering is started from below Scarpa's fascia in a central portion of the flap and extends to a point in the dermis at A, B, and C. This is diagramatically represented in Figure 3-29. By so trimming, the distal fat remains well vascularized from the subdermal vascular plexus, and areas of fat necrosis that can occur during the late postoperative period may be prevented.

In most reconstructive procedures that require the transfer of tissue by a pedicle flap, it is necessary to overcorrect the defect to allow

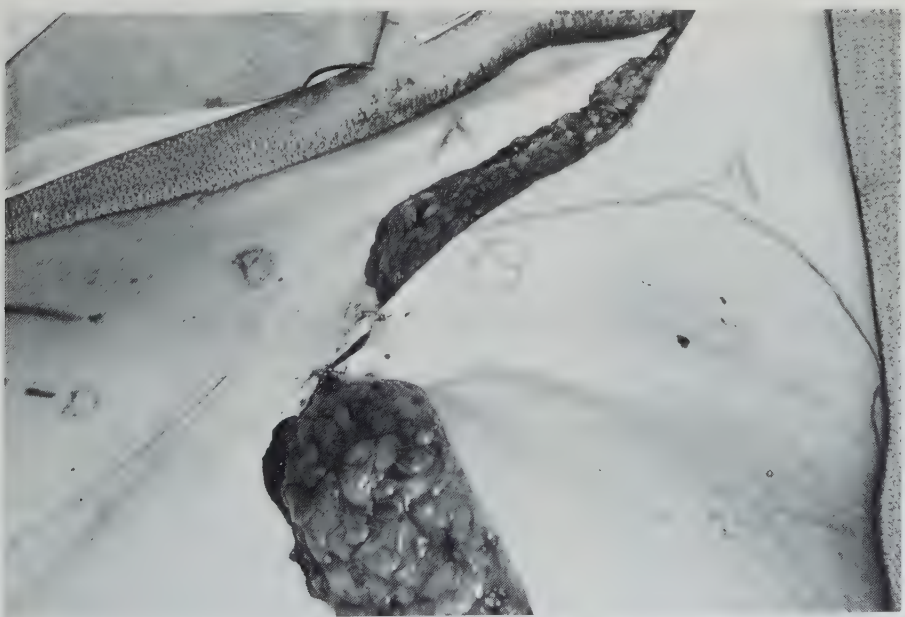


Figure 3-26 The flap is in place on the chest with central fixation before being shaped.

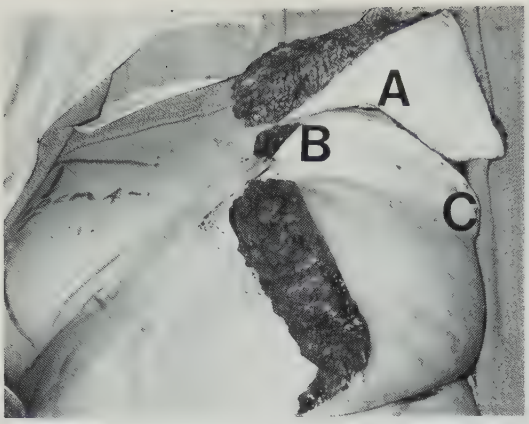


Figure 3-27 The upper portion of the flap that extends beyond the mastectomy defect (line *BAC*) is trimmed away.

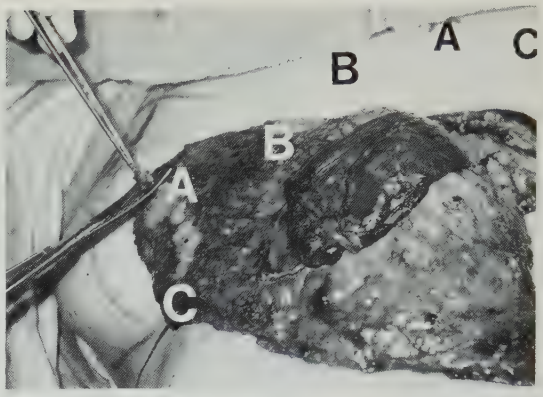


Figure 3-28 The flap is turned over on the chest for sloping the upper part of the new breast. The fat is trimmed away from the underside of the flap so that the subdermal vascular plexus is not disturbed.

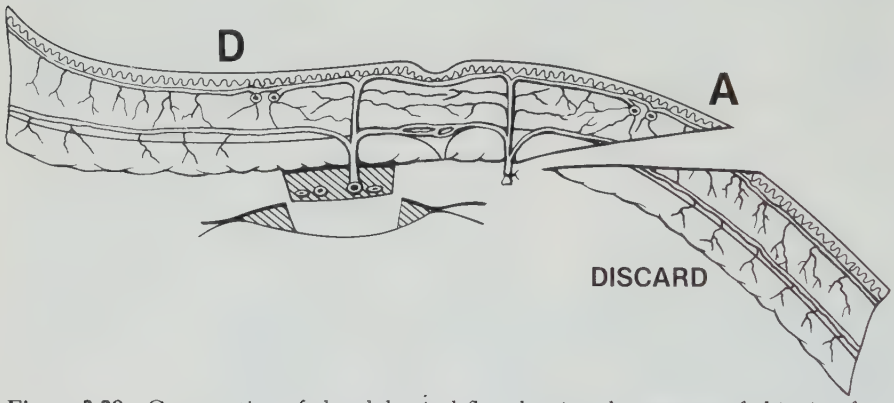
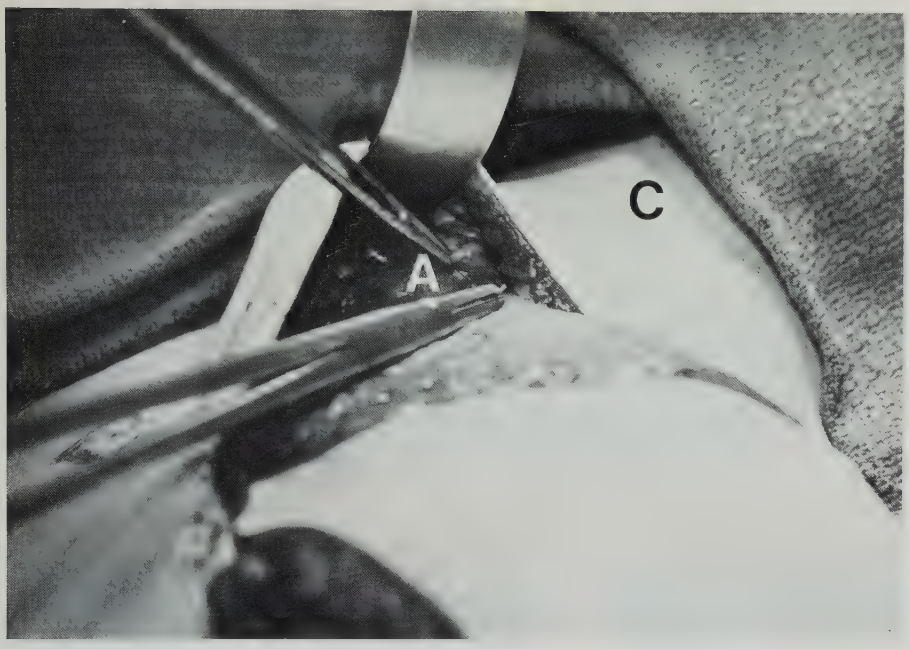


Figure 3-29 Cross section of the abdominal flap showing the manner of thinning from the underside to the dermis to protect the subdermal vascular supply to the fat.

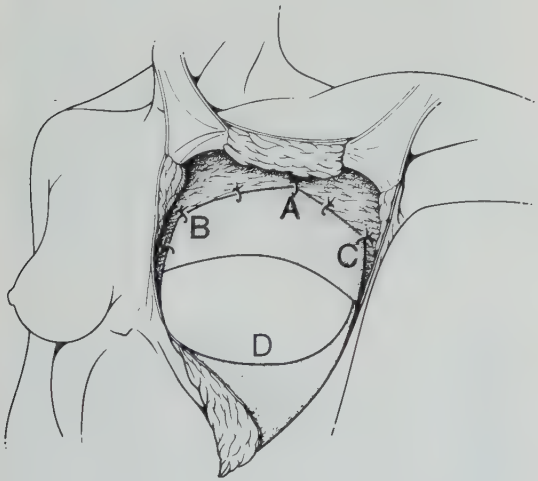
for subsequent shrinkage. With this transverse abdominal island flap, there is generally too much tissue available, and it must be accurately trimmed. If too much bulk is left high on the new breast, it will not shrink but will remain and give an unnatural high projection to the breast.

The thinned upper edge of the flap is secured to the pectoral muscle fascia with nylon sutures across the upper limits of the mastectomy defect (points A, B, and C, Figure 3-30). The skin edges across the new breast are now temporarily approximated with staples (Figure 3-31). The lower wing of the flap is worked laterally from the medial-central fixation point to the mid-point of the inframammary line, where it is temporally stapled in place (Figure 3-32). The inferior portion of the flap is tucked under the lower lateral portion of the new breast, and the temporary stapling is completed (Figure 3-33). **Temporary staple fixation is an invaluable aid in the shaping process. There is a need for constant adjusting and altering until the desired size and shape is achieved.**

At this point the patient is placed in the sitting position, and the two breasts are examined for a final adjustment of the inframammary line, natural breast shape, and in this case symmetry. After the "match" has been achieved, the inframammary skin line is marked along the inferior



A



B

Figure 3-30 **A, B:** The flap is sutured to the pectoral fascia across the upper limits of the mastectomy defect (*BAC*). Note that the buried portion of the flap above the mastectomy scar and the portion below the inframammary line are deepithelialized.

wing of the flap (Figure 3-34) and the staples are removed. This inframammary line on the flap (point D) is incised, and the epithelium is removed to the inferior tip of the flap (Figures 3-35 and 3-36). In this case there was too much bulk to the new breast, and the inferior wing of the flap was trimmed on the underside, leaving

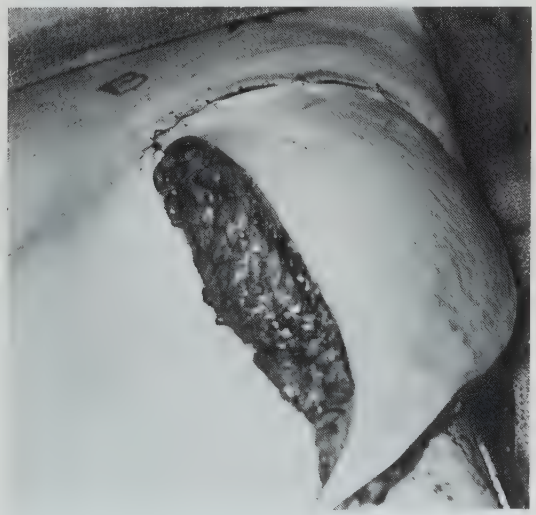


Figure 3-31 Skin edges are approximated with staples.

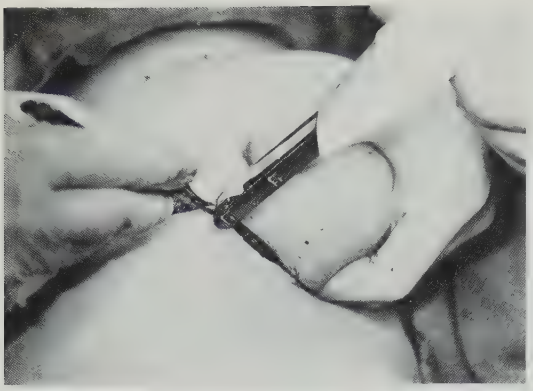


Figure 3-32 The lower wing of the flap is turned under the lower outer quadrant of the new breast and temporarily stapled in place.

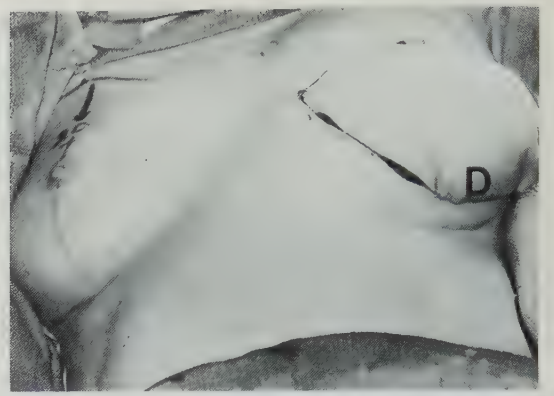


Figure 3-33 The final adjustments have been made to achieve the best possible size and shape.

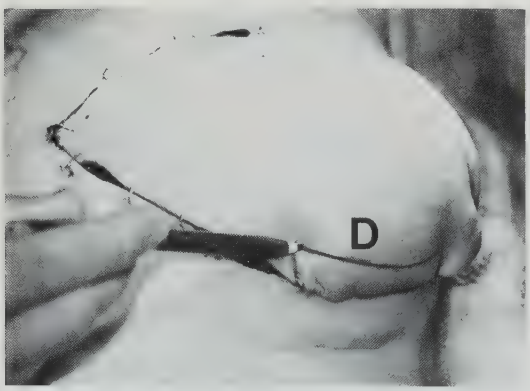
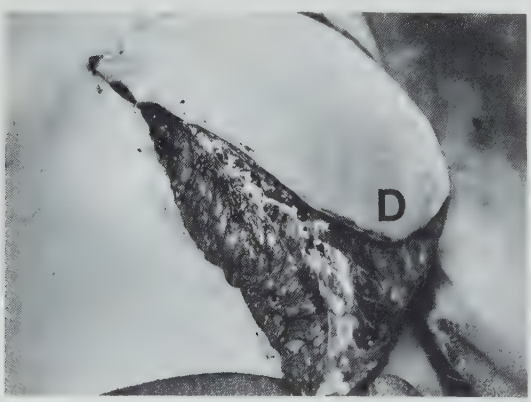


Figure 3-34 The inframammary line is marked on the new breast.

Figure 3-35 The epithelium is removed from the inframammary line to the tip of the flap.



the subdermal plexus undisturbed to nourish the fat (Figure 3-37). The inferior wing of the flap is again turned under the lower outer quadrant of the new breast and stapled into position (Figures 3-38 through 3-41).

After determining that the best possible shape and size has been obtained, the staples are removed and the breasts wounds are repaired with running sutures of 5-0 plain catgut. Subcutaneous or dermal sutures are used at only a few key points or not at all (Figure 3-42).

Figure 3-36 The breast flap after deepithelialization of the inferior portion that will be buried.

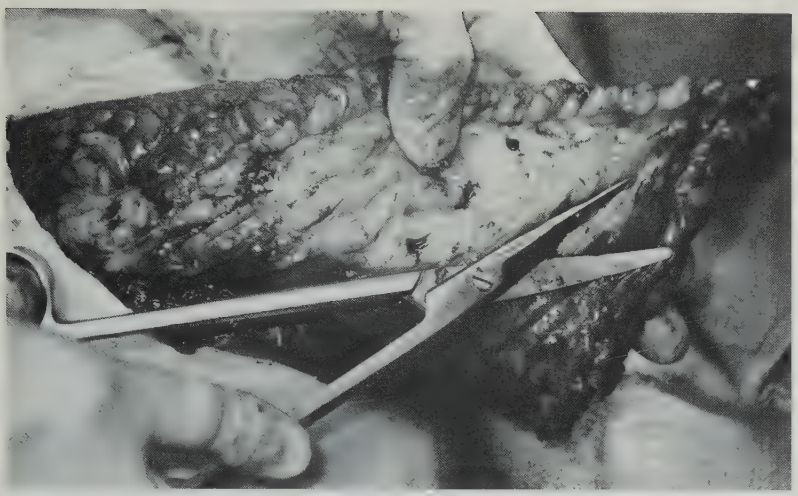


Figure 3-37 Any excess fat is trimmed away from the underside of the flap.

Figures 3-38 through 3-41 The deepithelialized wing of the flap is turned under the lower outer quadrant of the new breast and temporarily stapled into place.

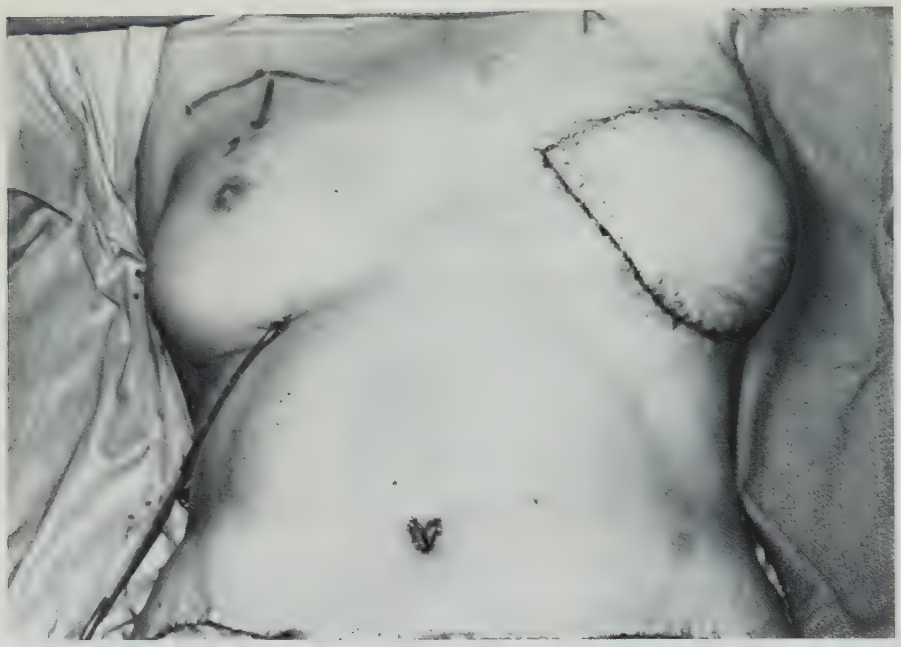


Figure 3-42 The final skin closure is completed.

It is unnecessary to use deep fixation sutures in the lower portion of the new breast. The inferior wing will rest in the lower outer quadrant of the new breast in an unencumbered fashion without this fixation. Fixation sutures within the substance of the fat flap and between the flap and the chest wall are not necessary for projection or shaping and will likely cause vascular insufficiency with subsequent tissue loss or fat necrosis. The flap should not be sewn into a compact form to obtain the breast shape. Rather, it should be firmly secured to the pectoral fascia high on the chest wall and the new breast allowed to project from the mastectomy skin incision to give the desired projection and ptosis.

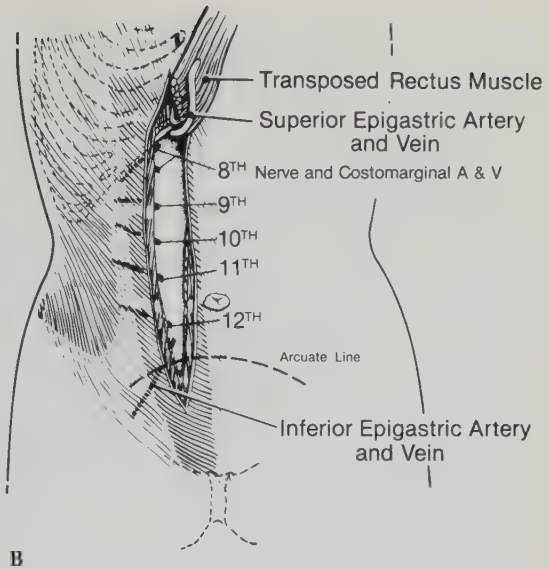
Abdominal Wall Closure

Abdominal wall closure is usually completed immediately after the abdominal flap is delivered to the chest wall. Note the condition of the abdominal wall after harvest of the rectus-vascular pedicle (Figure 3-43). The abdominal wall is repaired by approximating the preserved portion of the rectus muscle from the first transverse inscription to the arcuate line using a continuous 2-0 Vicryl polyglactin suture (Figure 3-44). This suture necessarily includes the tough transverse tendinous inscriptions in the rectus muscle. Small bites of anterior rectus sheath are taken with the muscle to avoid cutting through the muscle fibers. The final anterior abdominal wall closure is accomplished with a continuous suture of No. 1 nylon using healthy bites of anterior rectus sheath with each pass of the needle and a gradual tightening of the closure as the repair progresses (Figure 3-45). A second layer of continuous No. 1 nylon (needle passed in the same direction as the first repair) further reinforces the abdominal closure (Figure 3-46).

Interrupted sutures and individual mattress sutures have no place in the closure of the anterior sheath. Interrupted sutures tend to cut through the sheath as they are tied down. When using the running permanent nylon suture, there is a constant adjustment of tension and a distribution of the stress on the rectus sheath throughout the length of the wound edges.

A secure tie should be placed at the beginning and end of this No. 1 nylon, and these knots should be buried to avoid a troublesome

A



B

Figure 3-43 A, B: The abdomen after harvest of the rectus pedicle; note the preserved lateral and medial portions of the rectus muscle.

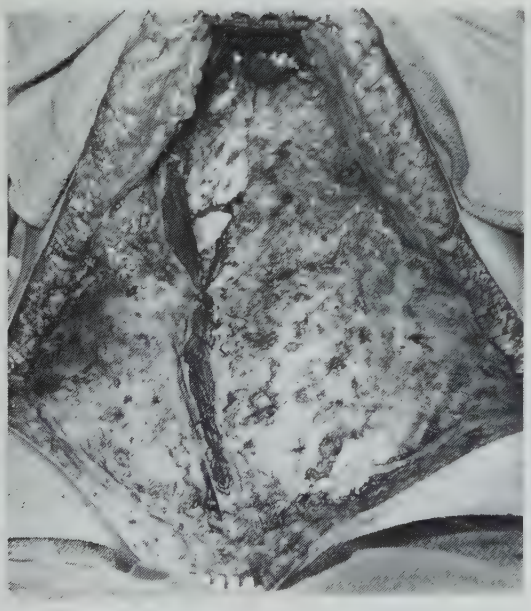


Figure 3-44 The rectus muscle is approximated from the first transverse inscription near the umbilicus to the arcuate line.

tender point beneath the abdominal skin at a later date. Among the 80 unilateral breast reconstructions done at the time of this writing, a primary repair has been accomplished in every case and there has been no need for the use of synthetic mesh material. Only one hernia has occurred in this series, and that was due to a technical error. Preoperative preparation of the bowel and selective harvest of the rectus makes the primary repair of the abdominal wall in unilateral cases possible and desirable (see Chapter 7).

The abdominal wound is drained with 10-mm constant-suction drains brought out through separate small incisions in the inguinal regions (Figure 3-47). The abdominal skin is repaired with interrupted and continuous sutures of 3-0 polyglactin sutures in the subdermal plane (Figure 3-48).

Reconstruction of the Umbilicus

Reconstruction of the umbilicus is often a problem in unilateral cases because closure of the anterior rectus sheath pulls the umbilical stalk

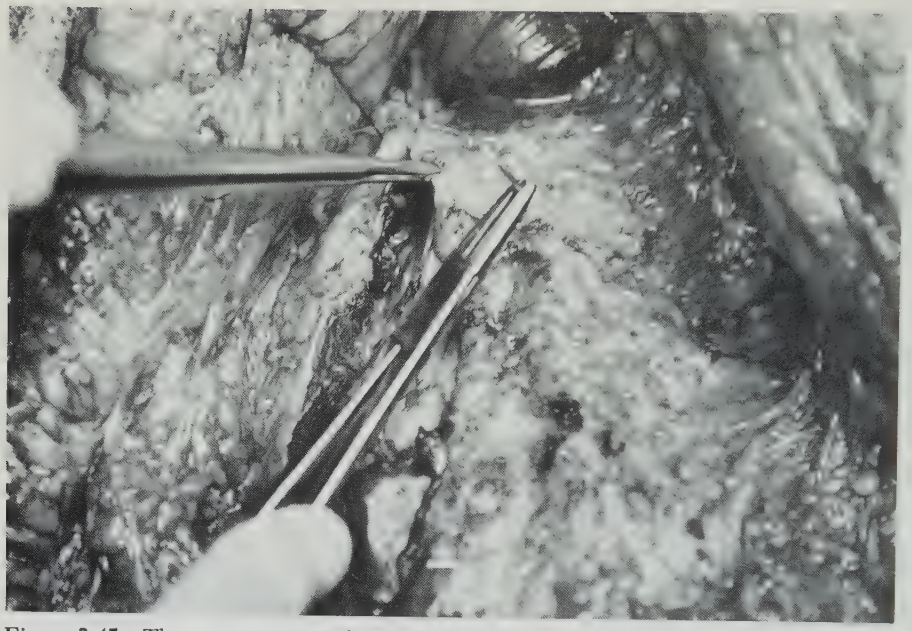


Figure 3-45 The anterior rectus sheath is repaired with a continuous No. 1 nylon suture.

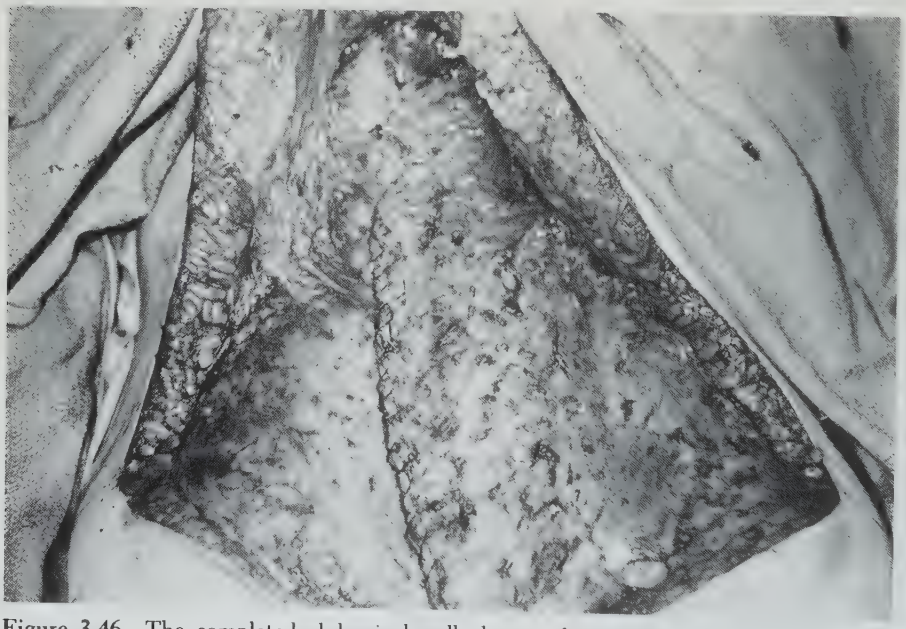


Figure 3-46 The completed abdominal wall closure after reinforcing it with a second suture layer.

toward the side of the closure. Attempts to bring the umbilicus back to the midline often lead to slow healing and do not achieve the desired midline location in the long run. Total success with the umbilicus has not been achieved in every case. The best method of umbilical reconstruction now appears to be reimplantation of the umbilicus as a full-thickness graft.

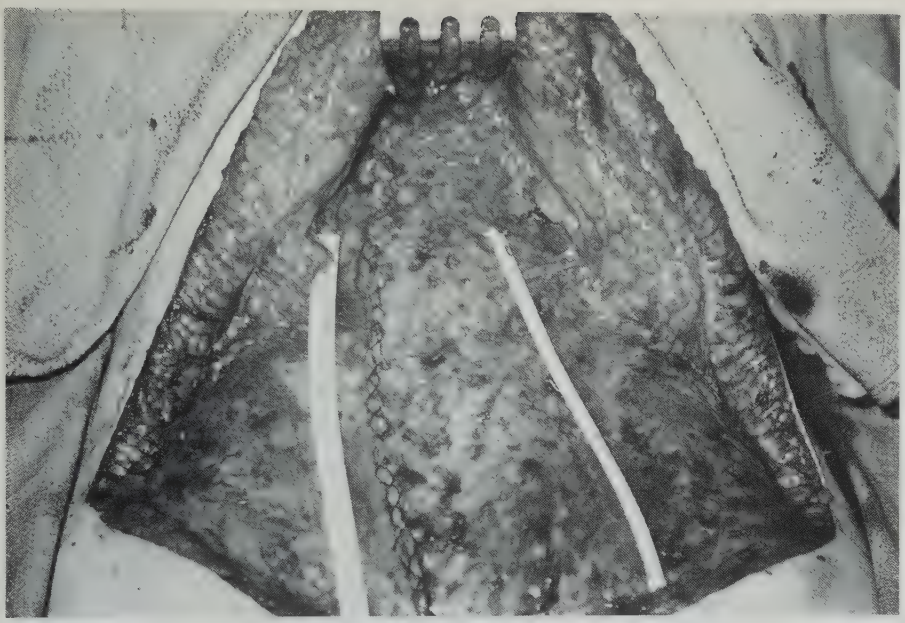
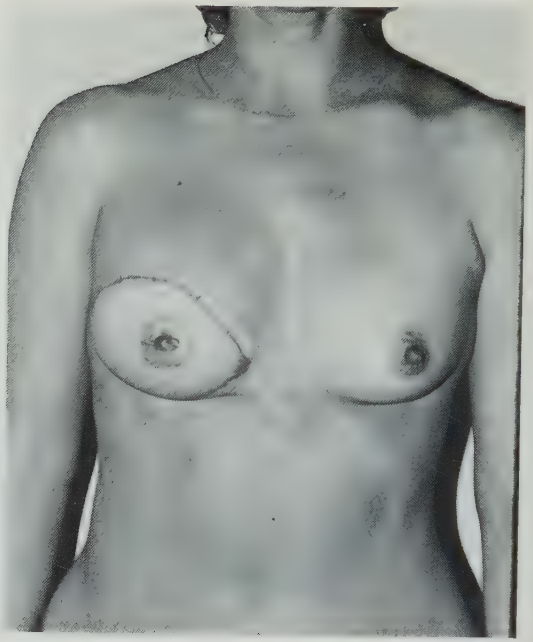


Figure 3-47 The abdominal wound is adequately drained.

Figure 3-48 The final dressing is limited to 1-inch sterile paper adhesive.

The umbilical stalk is amputated and the umbilicus removed from the abdominal flap. The new location for the umbilicus on the abdomen is incised in a Y design. The umbilical graft is defatted and the stalk reattached to the anterior rectus sheath in the appropriate midline position with two 5-0 nylon sutures. The V-shaped skin wedge from the Y abdominal incision is sutured

A



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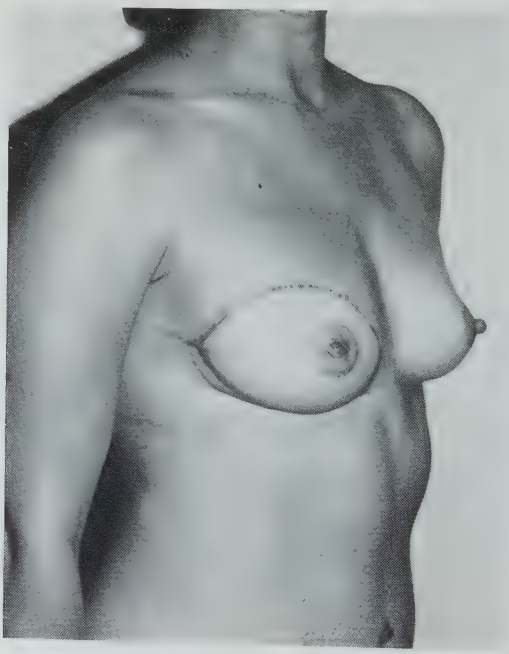
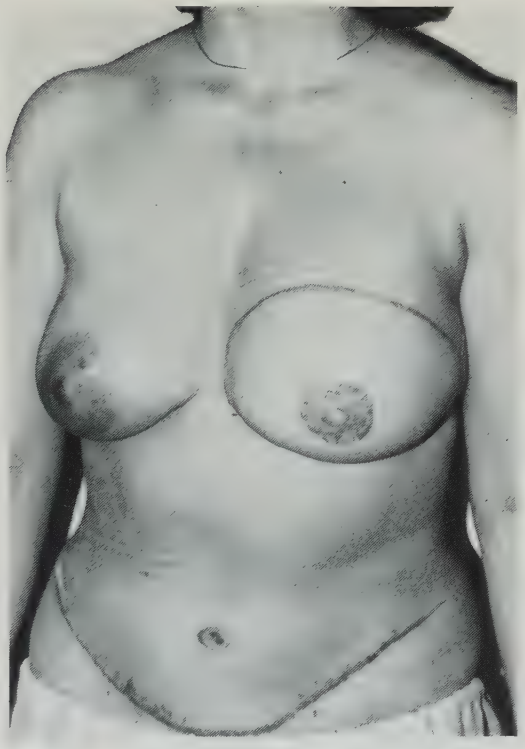
C



D

Figure 3-49 A–D: This 35-year-old woman underwent reconstruction on 25 January 1983 and nipple-areolar reconstruction on 17 May 1983.

A



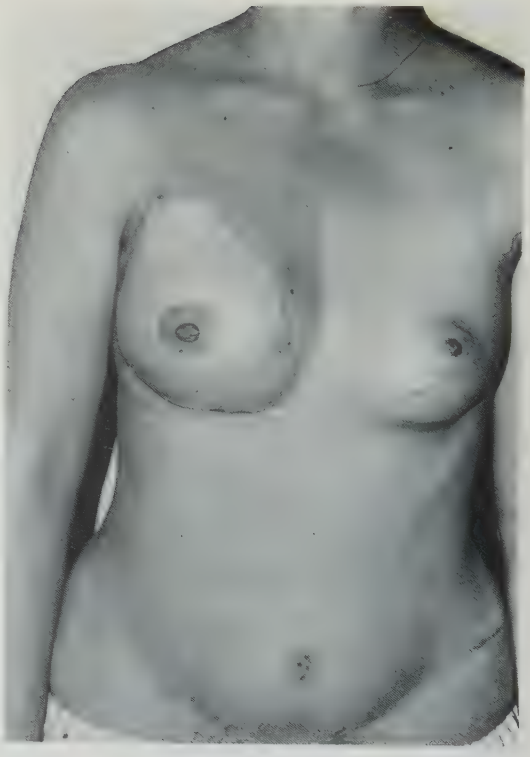
B

C

D

Figure 3-50 A–D: This 38-year-old woman underwent reconstruction on 8 July 1982 and nipple-areolar reconstruction on 2 September 1982.

A

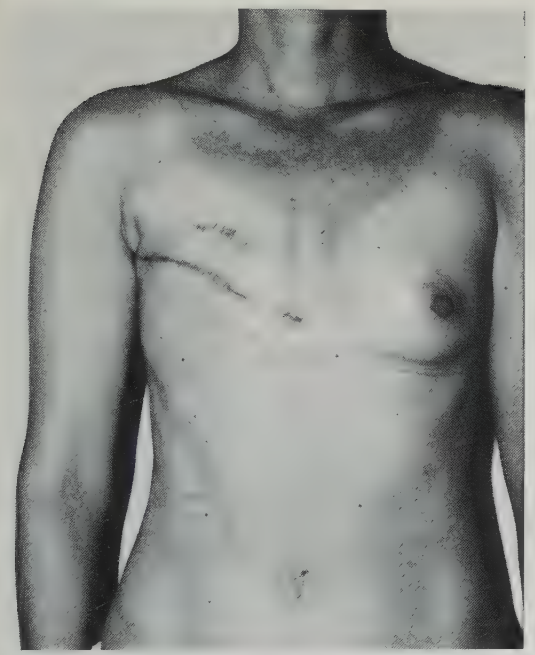


B

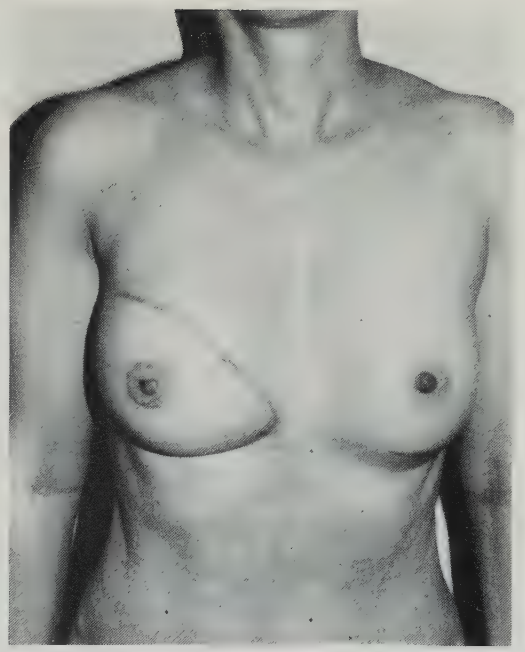
C

D

Figure 3-51 A–D: This 40-year-old woman underwent reconstruction on 7 September 1982 and nipple-areolar reconstruction and left subglandular augmentation (140-cc implant) on 17 December 1982.



A



B

C

D

Figure 3-52 A–D: This 38-year-old woman underwent reconstruction on 22 November 1982 and nipple-areolar reconstruction and a left submuscular implant (180 cc) on 25 February 1983.

into a slit in the umbilical graft and secured to the fascia with 5-0 polyglactin sutures. Several such sutures are placed around the umbilicus, and the skin is oversewn with a continuous suture of 5-0 plain catgut.

All breast and abdominal wounds are covered with a single layer of 1-inch sterile paper adhesive. Each drain is surrounded by a single 4 × 4 inch bandage. No other dressings are used. The new breast is not covered by compression dressings and is easily observed throughout the early postoperative course. The sterile 1-inch adhesive is not removed for 3 weeks postoperatively.

Nipple and Areolar Reconstruction

With this method of breast reconstruction, the nipple-areolar reconstruction should be delayed 4 to 6 weeks. This transverse abdominal island flap does not have normal blood flow for at least 3 to 4 weeks postoperatively. Temperature monitoring shows that the new breast is 2°C cooler than the normal breast for 10 days or longer, and tissue oxygen measurements are lower than normal during the early postoperative course. Therefore the skin graft required in nipple and areolar reconstruction when performed on this newly transferred flap may not survive. Nipple-areolar reconstruction is not discussed in this book. However, a dermal fat flap technique has been employed over the past year with encouraging results.[17]

Adjustments in the Opposite Breast

A reduction, or mastopexy, on the opposite breast should be delayed until the time of the nipple and areolar reconstruction, at which time size and shape comparisons can be made after the postoperative edema in the reconstructed breast has subsided and healing is near completion. **Although a second operation to complete the reconstruction may seem inconvenient, expensive, and time-consuming, it has proved to be vital in achieving the best possible result in terms of both nipple-areola viability and symmetry of the breast.**

Figures 3-49 through 3-52 show representative results after breast reconstruction of a modified radical mastectomy defect using the TAIF procedure.

4

Radical Mastectomy Reconstruction

To women who have experienced a radical mastectomy, the most distressing deformity is that of the upper chest, which includes loss of the anterior axillary fold and the infraclavicular hollow with the parasternal skeletonization of the ribs. Most women put this upper chest problem first in their reconstructive wish book because without fullness in these areas it is difficult to wear even a simple open-necked blouse or bathing suit. Thus it is important that reconstruction of the axillary fold and the infraclavicular hollow be carefully planned with well-vascularized tissue to effect anatomical restoration in these areas.

The tissue replacement requirements after a classic Halsted radical mastectomy are as great or greater than that of any other reconstructive procedure, and when restoring this deformity the entire abdominal flap is usually needed for the reconstruction. As a rule of thumb, one-half of the tissue of the abdominal flap is required to replace the missing pectoralis muscles along with the lost axillary contents, and the other half is relegated to reconstructing the breast mound. Now that this method of reconstructing the radical mastectomy defect is available, it is no longer acceptable to leave gaps and depressions in the region of the anterior axillary fold and the infraclavicular area as has been standard practice with the latissimus dorsi and implant reconstructions in the past.

The straightforward radical mastectomy restoration is discussed first. Occasionally there are extenuating circumstances that make the problem more difficult, e.g., chest wall irradiation damage and the scarred abdomen. These unusual problems are discussed in Chapter 6.

The illustrative case is a 50-year-old woman who underwent a left radical mastectomy in 1965 (Figure 4-1). She had a large pendulous right breast and an unscarred abdomen. She was a smoker but agreed to stop smoking 4 weeks before surgery.

Preoperative Planning

In the initial discussion with this patient, it was agreed that a major part of the surgical effort would be directed toward restoring the anterior axillary fold and the upper chest defect (Figure 4-2), and that the reconstructed breast would be of adequate size but would not match the opposite side. The patient understood that a second operation would be required to reduce the pendulous right breast and to reconstruct a nipple-areolar complex.

Chest

The operative plan was drawn on the patient the evening prior to surgery (Figure 4-3). Point

Figure 4-1 Illustrative case.

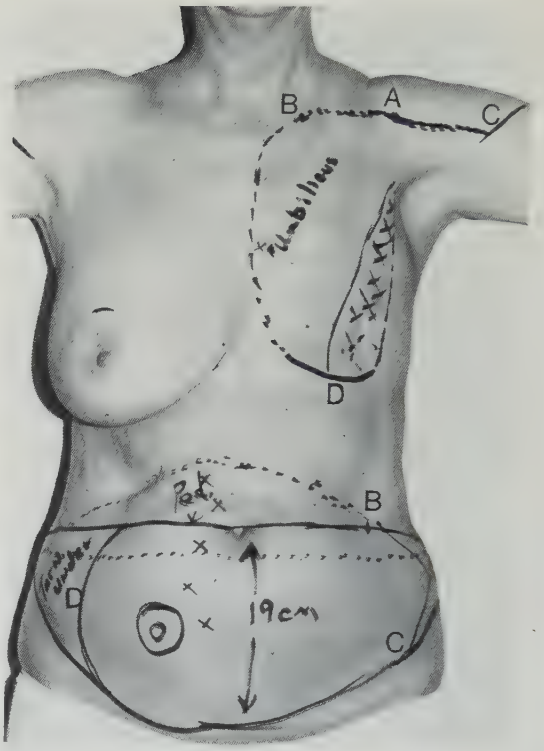


Figure 4-2 Preoperative planning.

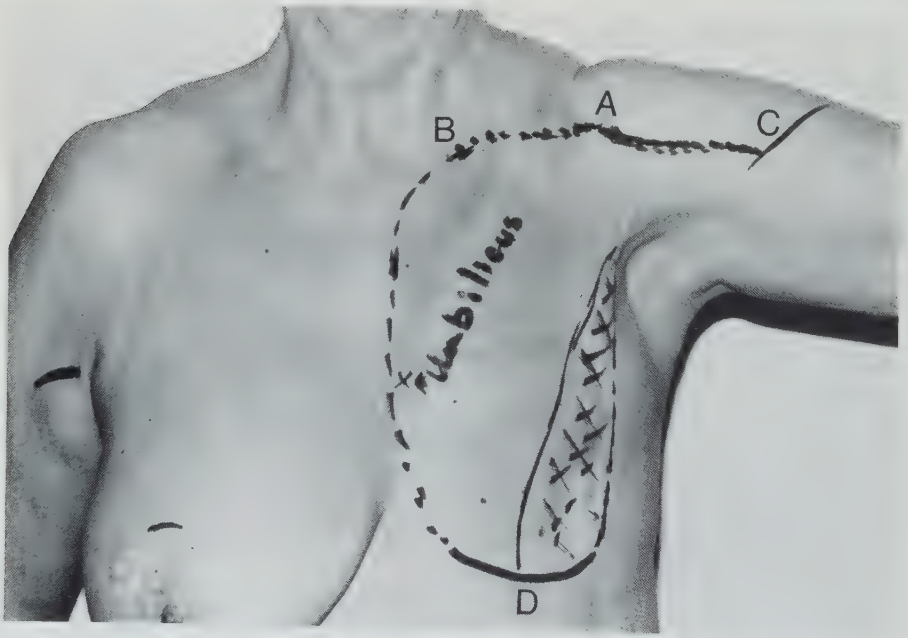


Figure 4-3 Points B, A, and C represent the upper limits of the radical defect. The wide mastectomy scar is marked with Xs. Point D is at the inframammary line.

C represents the groove between the deltoid and biceps muscles or the outer limits of the insertion of the excised pectoralis major muscle. Point A represents the lower limit of the origin of the deltoid muscle from the clavicle and the highest point on the chest of the mastectomy defect. Line C to A roughly corresponds to the cephalic vein and the lower border of the deltoid muscle. Point B is the upper medial limit of the pectoralis muscle extirpation and the sternal end of the clavicle. From point B the line of dissection extends down the lateral sternal border to the inframammary line. The inframammary crease is determined by comparison with the opposite side, but keep in mind that after closure of the abdominal wound this line will be pulled downward. The X near the parasternal line will be the approximate location of the umbilicus on the buried portion of the transferred abdominal flap.

The wide mastectomy scar is outlined for excision and marked with Xs in Figure 4-3. All of this scarring and thin skin will be removed to allow the new breast to project from the chest wall in an unencumbered way.

Abdominal Planning

In this case, as in most radical reconstructions, the entire abdominal flap (Figure 4-4) will be needed. If the abdomen is unscarred as in our example patient, the contralateral deep epigastric vascular system is the pedicle of choice (Figure 3-4). However, the ipsilateral pedicle in the radical mastectomy reconstruction will serve just as well and will provide the all important upper radical mastectomy defect with well-vascularized tissue. When such a large abdominal flap is required, it is very important to include as many of the periumbilical vascular perforators as possible with the flap. These perforators are marked with Xs on the pedicle side in Figure 4-4. The upper skin incision begins just above the umbilicus and extends to both flanks. The dotted line drawn on the abdomen above the solid line indicates the amount of additional fat taken with the flap so that the perforators above the upper skin incision can be included. The lower limit of the abdominal flap lies just above the pubis and extends on both sides to meet the upper

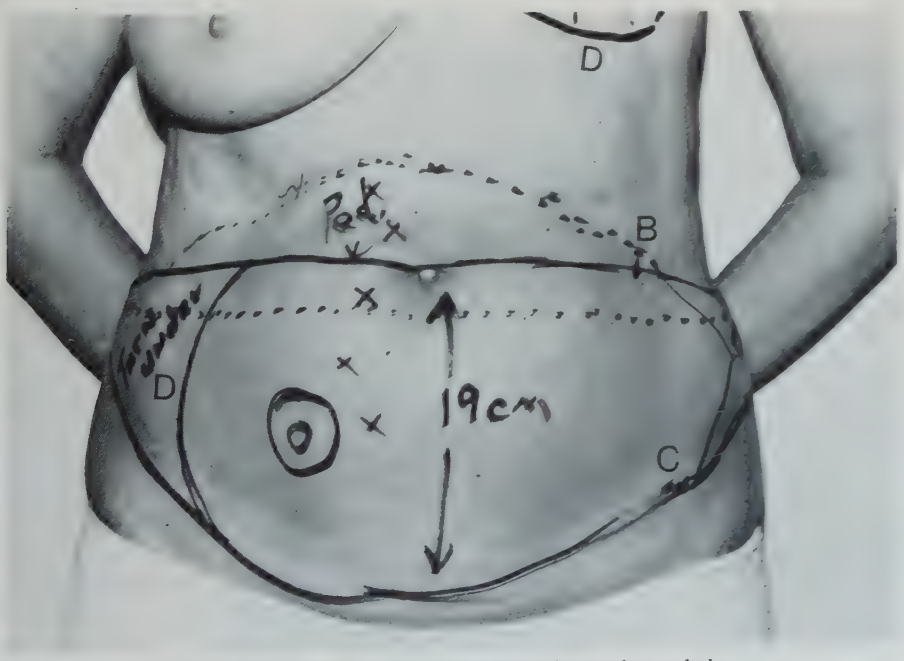


Figure 4-4 Abdominal flap design with a contralateral vascular pedicle.

incision in each flank. In this case the width of the flap at the umbilicus measures 19 cm. In most patients this dimension is between 14 and 15 cm. The dotted line below the umbilicus gives an idea of how many important periumbilical perforators would be excluded if the upper limit of the flap were to be made at that point. Note that only two perforators would be included, which is probably inadequate for total flap survival. Point C is marked in the region of the external oblique just lateral to the semilunar line. Approximate measurements from point C to points B and A are transposed from the chest to the flap. The extreme left tip of the flap can be deepithelialized and used to replace the missing axillary contents; however, if the circulation is poor after flap elevation, this tip should be discarded.

In the radical reconstruction, the location of point D (the inframammary crease) on the flap is only an estimate and cannot be finally determined until after the flap is in place on the chest wall and the breast has been shaped. Because the entire flap will be used in most of these cases, point D is located as far laterally on the flap as possible to provide for the projection of the breast but, at the same time, must remain in an area that will give adequate width to the lower portion of the breast. From the inframammary crease (D) to the right tip, the tissue will be deepithelialized and turned under the new breast for bulk and projection.

If the contralateral breast is small and the abdominal tissue abundant, point D can be located as in the modified radical (see Chapter 3), i.e., a measurement taken from transposed point A on the contralateral side down over the nipple to the inframammary crease (point D).

When the available tissue is inadequate to do the entire job (upper chest and breast) then the upper chest (anterior axillary fold and infraclavicular depression) takes precedence over the breast. In such a case the patient must understand preoperatively that the new breast may be small.

Surgical Procedure

Chest

Complete exposure of all structures from the origin of the pectoralis muscle and across its superior course to the deep insertion is critical to anatomi-

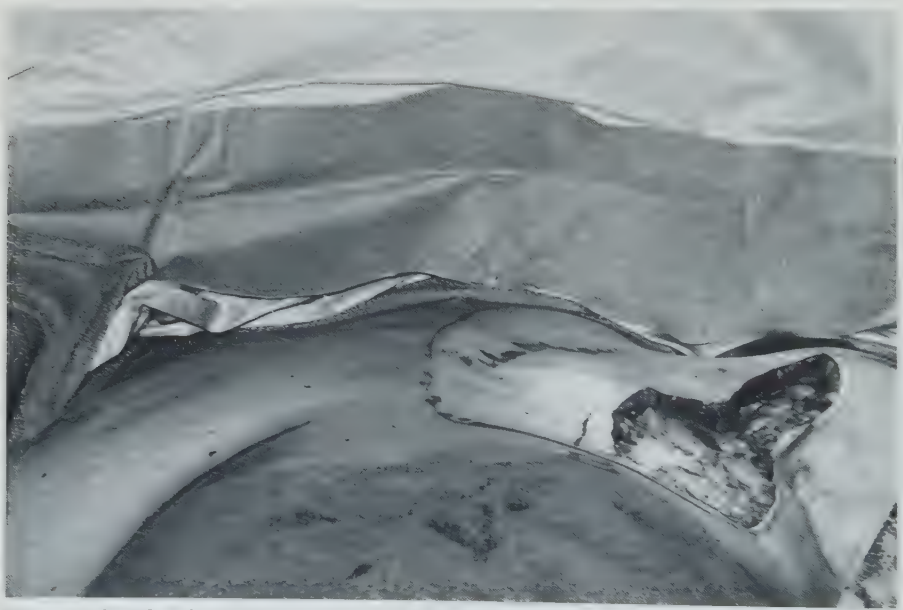
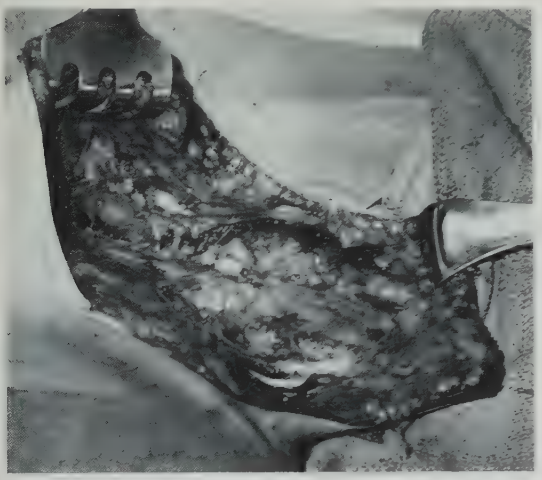


Figure 4-5 The chest after excision of the mastectomy scar.

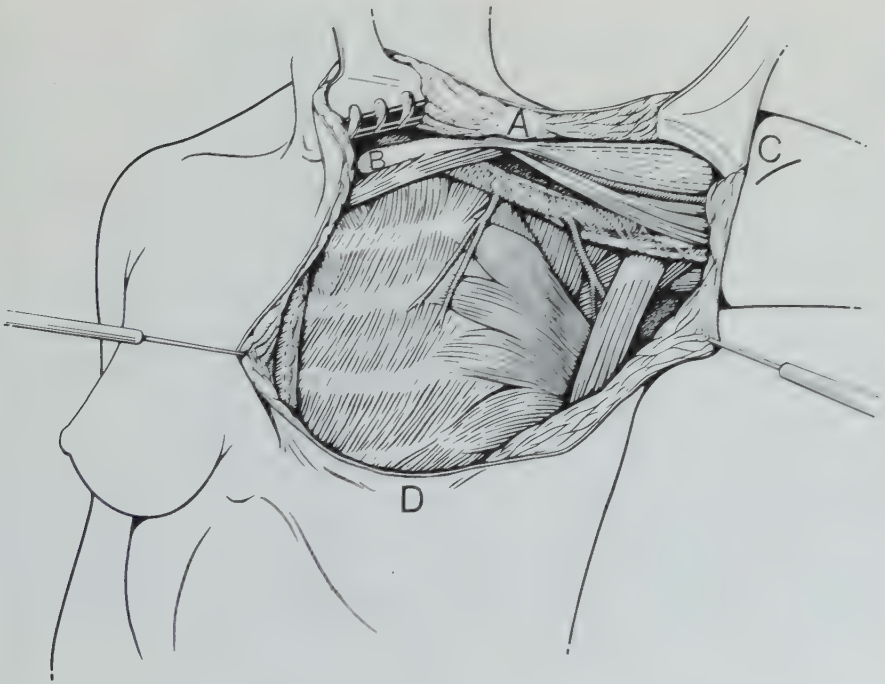
cal restoration of this deformity. The wide segment of mastectomy scar is excised and the remaining scar opened (in effect from point A to D) (Figure 4-5). The chest skin is elevated medially and laterally to the marked limits of the mastectomy (Figure 4-6A). Superiorly, the skin is elevated to expose the clavicle, the deltoid fascia, and the region of insertion of the pectoralis major muscle (the crest of the greater tubercle of the humerus) (Figure 4-6B).



A

This exposure of the anterior axillary structures can be facilitated by sharp dissection of the deep scar in a plane just under the skin. In this manner, the axillary vessels, the brachial plexus, and the cephalic vein will be easily exposed for the reconstruction and yet left undisturbed and uninjured. The skin flaps in these cases will remain viable if a thin layer of subdermal fat is elevated with the skin. Thin skin flaps are unrestricted by the scar and will conform to the underlying vascularized abdominal fat to provide good definition of the anterior axillary fold and breast.

As in the modified radical reconstruction, the fibrous adhesions at the inframammary line are left undisturbed. The final determination of the level of the inframammary crease is left to the



B

Figure 4-6 A: Elevation of the chest skin flaps to the outer limits of the mastectomy defect. B: The exposure necessary in this operation.

final stages of the breast shaping (after abdominal closure and upper breast fixation).

The subcutaneous tunnel is always made through the epigastrium and under the contralateral breast to connect with the upper abdominal dissection. This location of the epigastric tunnel to the contralateral side is the rule even when the ipsilateral vascular pedicle is used.

Elevating the Abdominal Flap

The abdominal flap is elevated (Figures 4-7 through 4-9) in a manner identical to that used in the modified radical reconstruction (see Chapter 3). The important fact to remember with the radical reconstruction is that the tissue requirements are great and the largest possible well-vascularized abdominal flap must be elevated. In most cases it will be necessary to use all of the tissue that is elevated, i.e., from one tip of the flap to the other. To facilitate the procurement of this massive, totally vascularized flap, the following points need to be emphasized:

1. In every case the periumbilical perforators well above the umbilicus, as well as those below it, should be taken with the flap.
2. In cases where the total vascularization of the flap is in question, steps should be taken to increase the vasculature of the flap. These steps include taking the flap higher on the abdomen or, in the case of lower midline scarring, using a double vascular pedicle (see Chapter 6).

Abdominal closure is performed as described in Chapter 3 for the modified radical mastectomy. A direct repair of the anterior rectus sheath has been possible in all cases of unilateral radical mastectomy reconstruction. No synthetic mesh has been used, and no abdominal hernias have occurred in this series of 31 radical mastectomy reconstructions.

Figure 4-7 The upper skin incision of the abdominal flap is beveled away from the flap and toward the epigastrium in order to include more vascular perforators with the flap and to gain extra tissue.

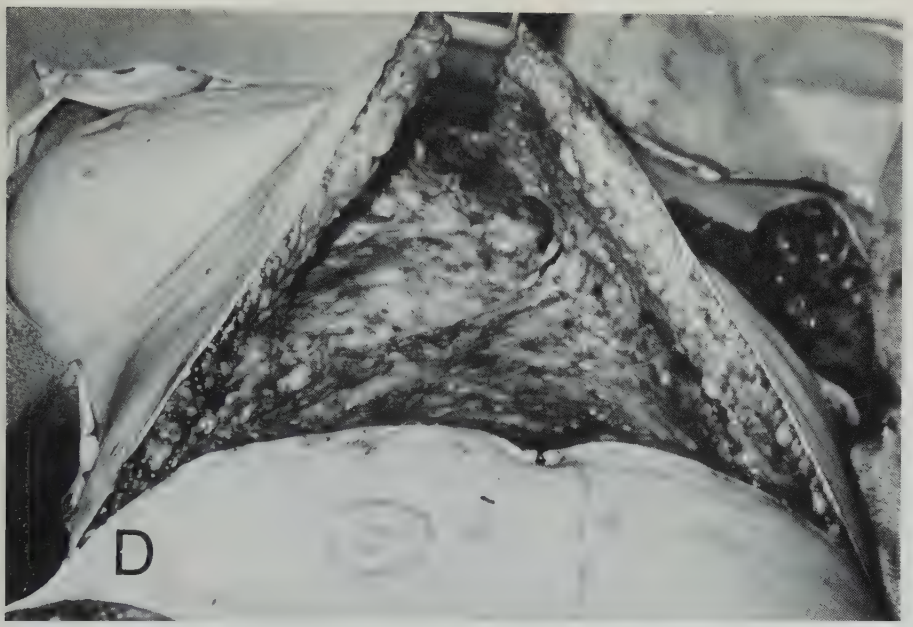
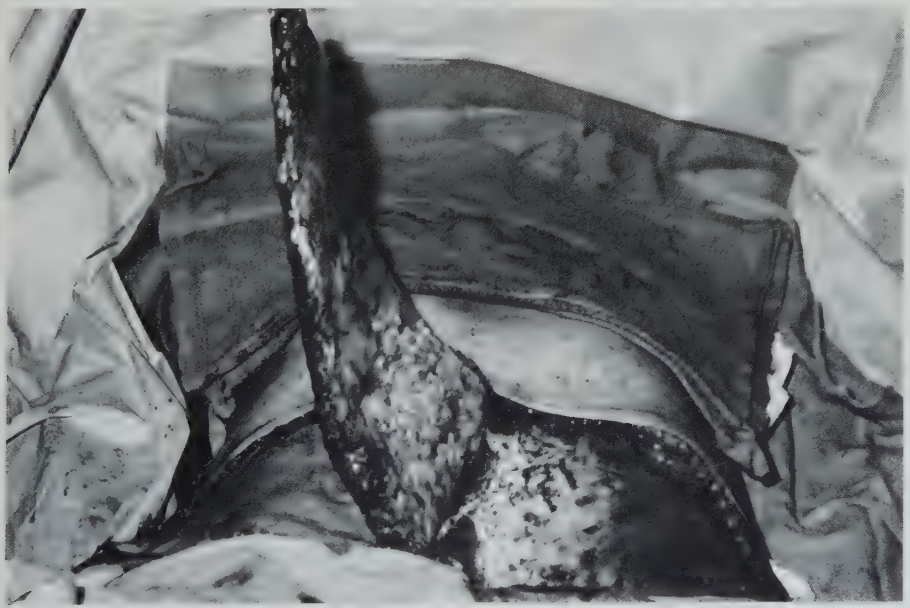


Figure 4-8 The tunnel is dissected through the epigastrium toward the side of the contralateral breast and into the mastectomy pocket. The inframammary area on the mastectomy side is not disturbed.



Figures 4-9 through 4-11 The abdominal flap is elevated as described in Chapter 3, passed through the tunnel into the breast pocket, and temporarily stapled at a medial point on the chest wall.

Figure 4-10

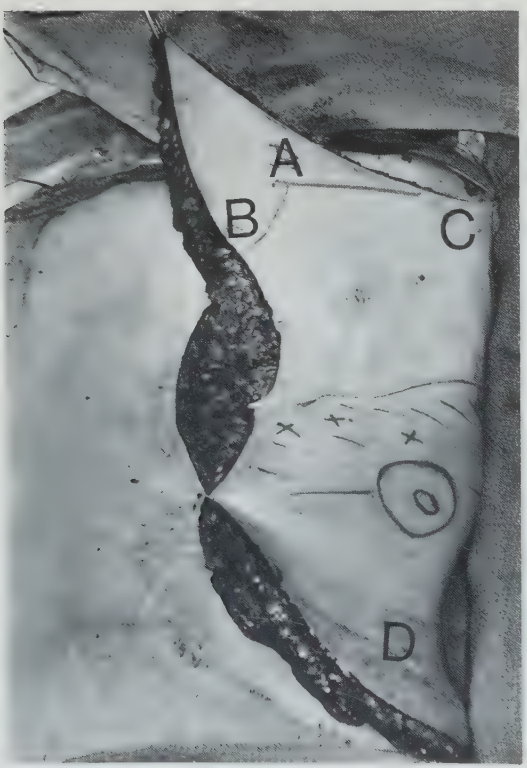


Figure 4-11

Filling the Anterior Pectoral Fold, The Infraclavicular Hollow, and Shaping the New Breast

The final process begins after the flap has been passed into the chest pocket (Figure 4-10) and the abdomen has been closed. Adequate exposure for the high aspects (B, A, and C) of this reconstruction is essential. The usual vertical radical mastectomy scar gives good exposure from the clavicle to the inframammary line after the chest flaps have been elevated. The transverse scar in some radical cases presents an exposure problem; however, with good retraction of the upper skin flap and adequate light this problem can be overcome.

The abdominal flap is temporarily positioned high in the chest (Figure 4-11, 4-12), and the chest skin is draped over the flap. The future suture lines on the new breast are drawn on the flap in their approximate location, and the skin well above this line (on the portion of the flap that will be buried) is removed, leaving a thick dermal bed (Figure 4-13). The exact location of this breast suture line is determined by the final shaping of the breast; therefore this first removal of skin from the buried portion should be conser-

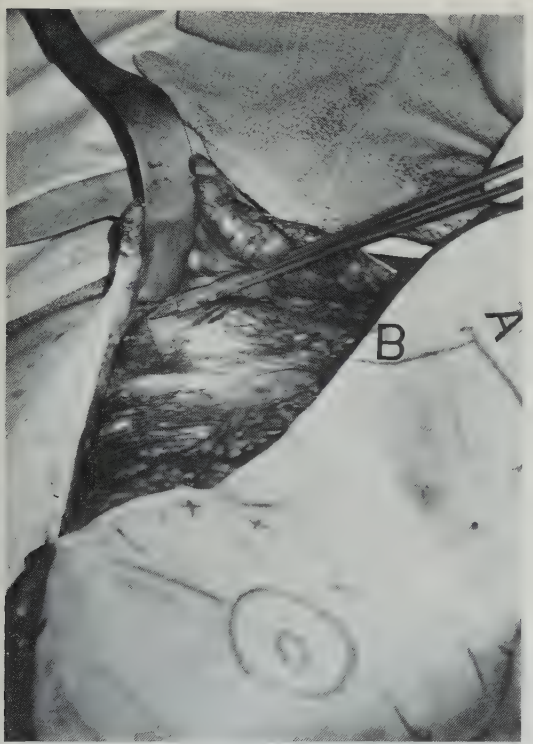


Figure 4-12 Scarpa's fascia at point B on the flap is sutured to the periosteum and ligaments at the sternoclavicular joint (point B on the chest).

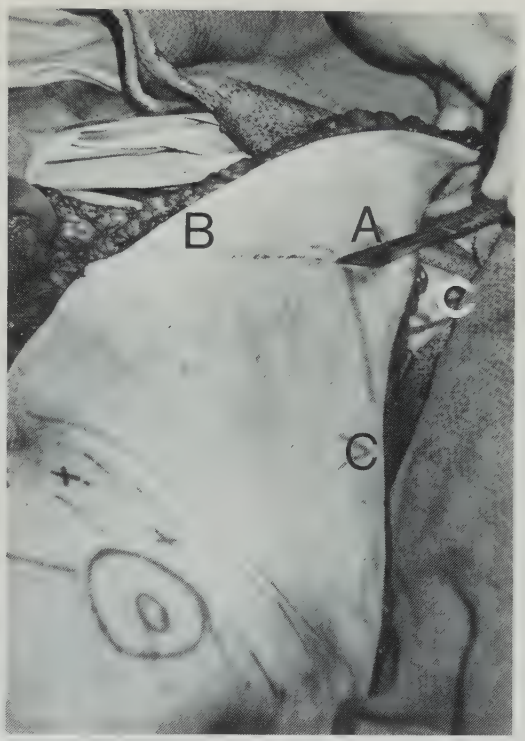


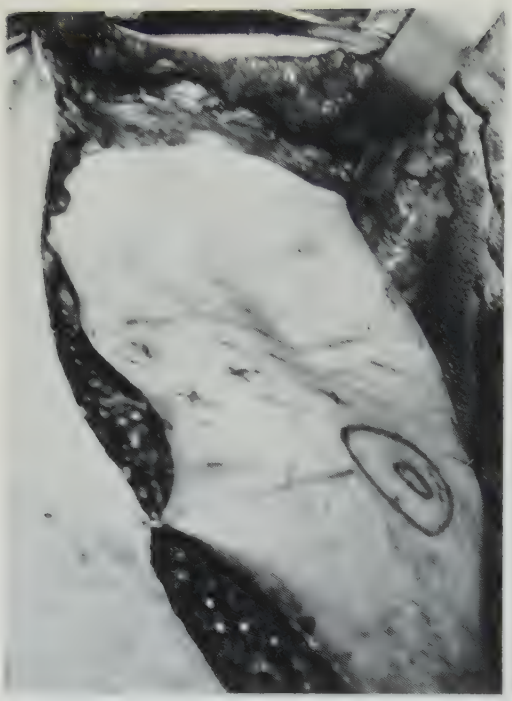
Figure 4-13 After an approximate skin suture line on the new breast has been determined, the epithelium is removed from the upper part of the flap, and the tip is turned into the anterior axilla.

vative and not approach the future suture line, thereby allowing for any final alteration. It is important to preserve as much dermis as possible for tissue viability and to provide a strong dermal bed which will aid in permanent fixation to the structures across the upper limits of the chest.

The flap is spread or angled across the upper chest to put the bulk of the tissue in the pectoral fold (C) but also to cover the parasternal depression (skeletonized ribs) at point B in Figure 4-14A. The first 3-0 nylon suture is passed from the dermis at point C on the flap into the tendon of the long head of the biceps (point C on the upper arm). Other possible structures suitable for strong fixation at point C (pectoralis major muscle insertion) are the crest of the greater tubercle of the humerus and the tough outer limits of the deltoid fascia. **A permanent suture of monofilament nylon is preferred for this critical repair to the humeral structures and across the upper reaches of the chest.**

The next suture is placed in the dermis at point A on the flap and into the deltoid fascia at its lower origin from the clavicle (point A). These sutures at C and A effectively place the dermal surface of the flap along the edge of the deltoid fascia. This allows the distal end of the flap to be tucked into the upper axilla. This distal tip of the flap gives needed bulk to the upper axillary fold and to the axilla. The angle of this fold in the flap at A and C is not acute and should not interfere with the blood supply to the flap.

The next key suture on the upper reconstruction line is point B. The suture is passed through Scarpa's fascia at point B on the flap into the periosteum and ligaments at the sternal end of the clavicle (point B on the chest).

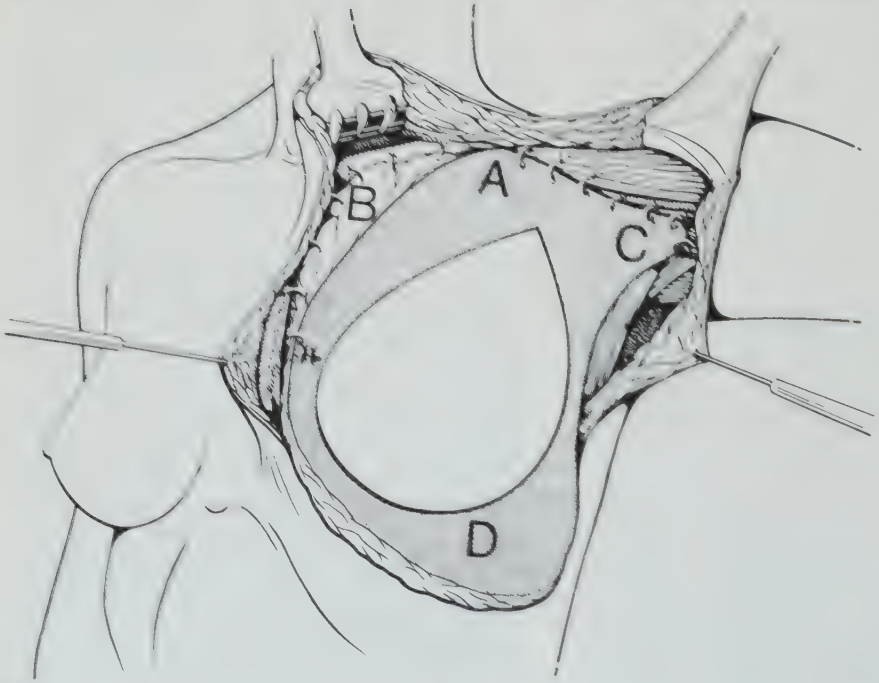


A

In the radical mastectomy the full thickness of the flap is needed over the entire upper portion of the reconstruction except for the medial or parasternal area (point B). By suturing Scarpa's fascia to the head of the clavicle (B) in this medial area, the breast is sloped and the full width of the flap can be utilized

Additional interrupted sutures should be placed between the dermis and the deltoid fascia at point C. The reconstruction line across the flap at C, A, and B can then be further secured with a continuous suture of 3-0 nylon. Several sutures will be needed in the parasternal region between Scarpa's fascia and the sternum from the umbilical region of the flap to the region of the clavicle (point B).

Figure 4-14 **A, B:** The dermal surface of the flap is sutured at point C to the insertion of the pectoralis major muscle (crest of the greater tubercle of the humerus or long head of the biceps tendon). Point A is sutured to the deltoid fascia and periosteum of the clavicle. When the repair is completed from CAB, the new breast will be securely suspended from the upper limits of the radical mastectomy defect.



B

No deep sutures should be placed low in the medial parasternal area that might narrow the tunnel around the vascular pedicle. In addition, no deep sutures should be placed below the pedicle during the breast-shaping process. Such deep sutures, if used, could have a bridling effect on the vascular pedicle, restricting venous return, especially during the early postoperative period when increased tissue edema or a small hematoma could cause further narrowing of the space around the pedicle.

The breast flap is now hanging from a line of sutures in tough tissues from B, A, and C, as seen in Figure 4-14B. No additional deep sutures are needed in the lateral breast area. The chest skin is now draped over the new breast, and the upper limb of the old mastectomy scar is temporarily attached with staples as far down on the breast as possible. This upper chest skin repair should be snug but not tight enough to restrict the underlying flap. A balance must be achieved between the use of chest wall skin and abdominal flap skin in the makeup of the new breast so as to produce a normal breast shape without interfering with the blood supply to the underlying flap. If too much flap skin is used, the new breast will have a wide, flat unnatural shape. If too little flap skin is used, the advantage of the abundance of skin available with this method of reconstruction will be lost and the new breast will not have the natural fullness that is desired. In addition, a tight skin closure over the new breast is to be avoided because of its detrimental effect on the overall blood supply to the flap.

Figure 4-15 The portions of the flap to be buried under chest wall skin are deepithelialized. The full thickness of the flap will be needed over the upper part of the reconstruction except near the sternum where it will be sloped.

The skin brassiere, containing elements of the chest wall skin as well as the abdominal flap skin, determines breast shape. Deep sutures used to produce breast shape (other than those across the upper limits of the mastectomy defect) *have no place in this operation.*

After making the multiple adjustments in the skin envelope to produce the desired shape and tension of the skin (using the advantage of temporary skin stapling) the new skin incisions on the flap are marked and incised. The upper, medial, and lateral portions of the flap which are to be buried are deepithelialized (Figure 4-15) and the skin edges temporarily stapled.

The inferior tip of the flap is tucked under the lower outer quadrant of the new breast and temporarily stapled (Figure 4-16). Adjustments in the level of the inframammary crease are now made by comparison with the contralateral breast. The area from the final inframammary line on the flap (D) to the tip of the flap is deepithelialized and turned under the breast, and the skin is repaired (see Chapter 3).

One large constant suction catheter is placed in the superior lateral aspect of the breast through the axilla and is brought out in a separate stab wound in the lateral chest skin. A second similar drain is placed in the medial gutter of the new breast pocket and brought out under the contralateral breast. In this way, the drain does not cross the vascular pedicle but does drain the epigastric wound around the pedicle.

The umbilicus is reconstructed as a full-thickness graft as described in Chapter 3. All wounds

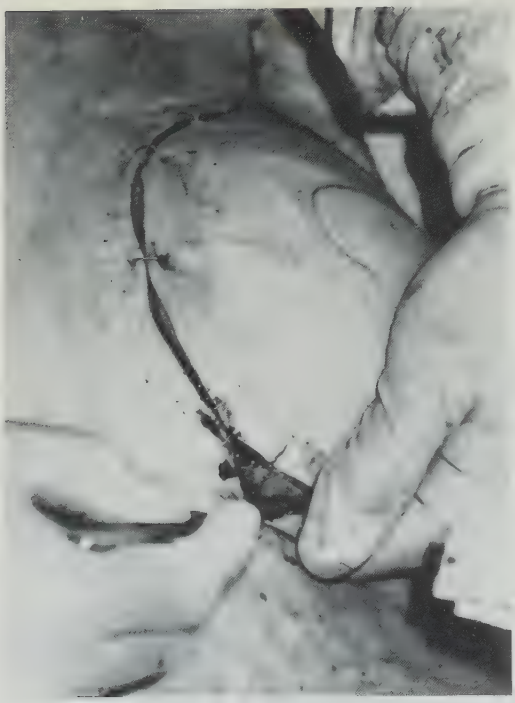


Figure 4-16 The breast is shaped by turning the inferior tip of the flap (distal to point D) under the new breast for added bulk and projection.

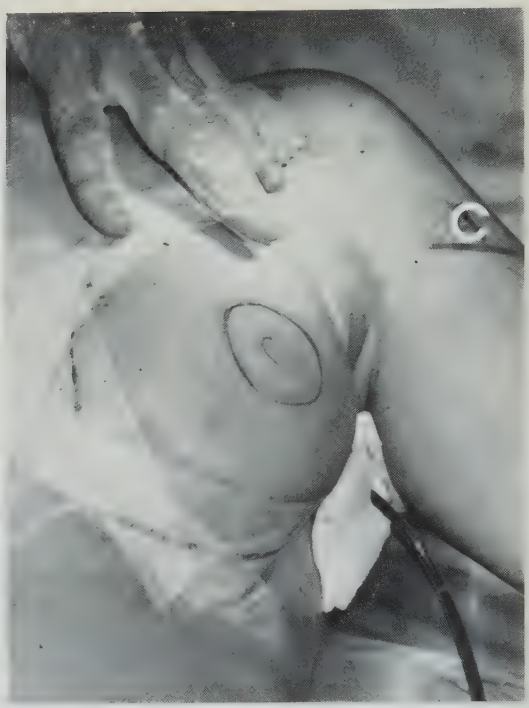
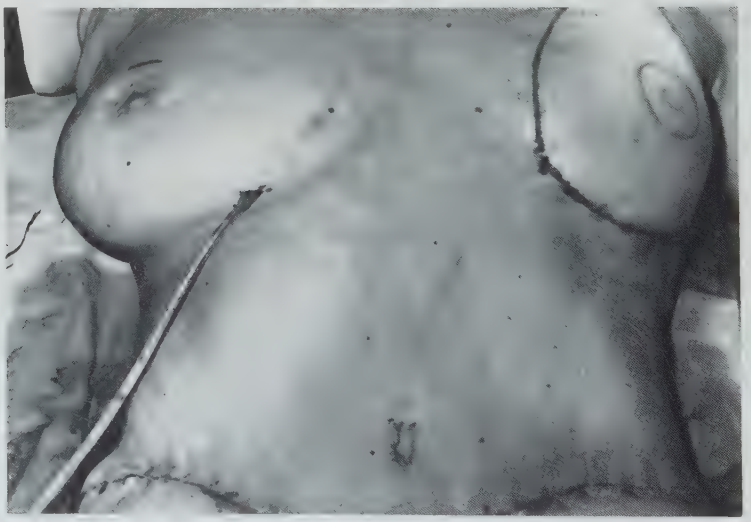


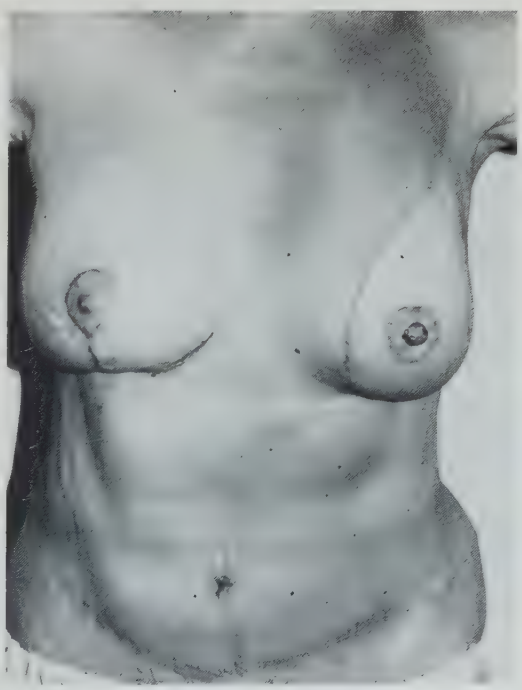
Figure 4-18



Figures 4-17 and 4-18 After final skin repair the suture lines are covered with sterile 1-inch paper adhesive. No other dressings are used.

A

B

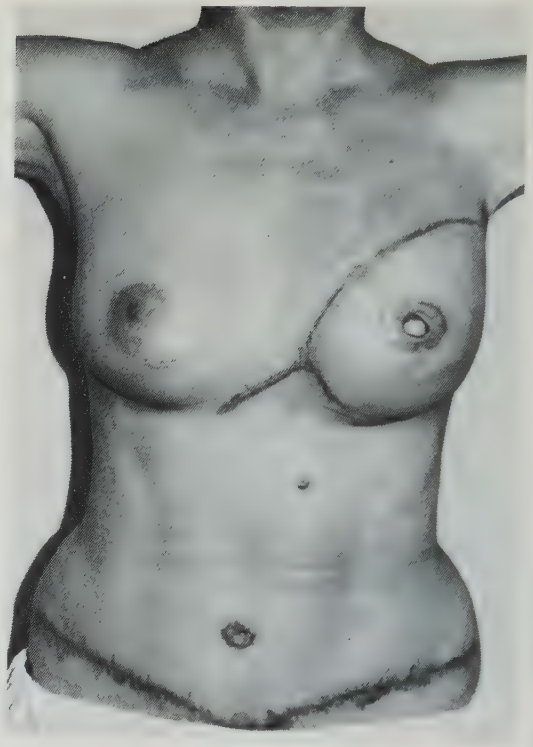


C

Figure 4-19 **A, B:** The patient in this case study at 6 weeks after left breast reconstruction. Note the new anterior axillary fold and infraclavicular filling. **A:** Before. **B:** After. **C:** The same patient after contralateral breast reduction and nipple-areolar reconstruction.

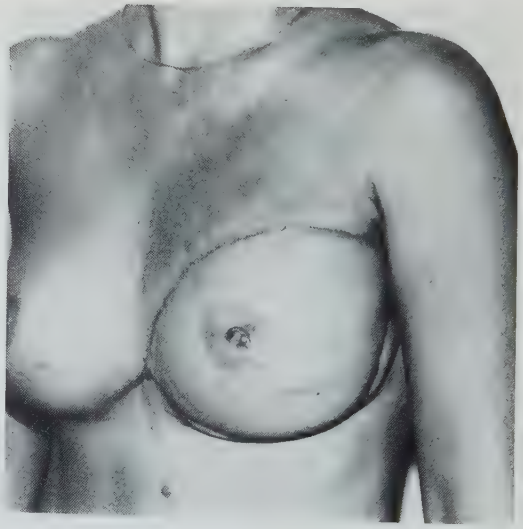
are repaired and covered with 1-inch sterile paper adhesive as previously described (Figures 4-17 and 4-18). The postoperative management of the radical mastectomy reconstruction is the same as with the modified radical mastectomy except that the patient is not permitted to raise the shoulder on the reconstructed side above 90 degrees for 6 weeks. This allows full healing of the dermis to the upper structures of the chest especially in the region of the pectoralis major insertion. The length of the hospital stay is identical to that for the modified radical mastectomy as is the postoperative morbidity. The final results of the patient in this case are shown in Figure 4-19.

A



B

C



D

Figure 4-20 A: A 40-year-old woman with radical mastectomy and hypertrophic scars. B,C,D: The same patient 8 months after breast reconstruction with the TAIF procedure.

A

B

Figure 4-21 **A:** A 48-year-old woman with a radical mastectomy. Reconstruction was done on 9 February 1982. **B:** The same patient 1 year postoperatively.

Altering the Contralateral Breast

When a reduction or mastopexy is indicated on the contralateral breast, it is best performed as a secondary procedure usually at the same time as the nipple-areolar reconstruction. The contralateral breast alteration in these patients must be accomplished in such a way as to produce a rounded breast with a slight ptosis. The cone-shaped breast produced by the standard breast reduction operations is not compatible with the TAIF reconstructed breast. Experience has shown that the best method of reducing the contralateral breast to effect a match with the TAIF breast is to use a technique of lower breast amputation (cresent shaped) with a central breast pedicle to the areola and nipple. *Minimal* vertical skin take out below the new areola (between the lower limbs of the keyhole) is important in producing this shape.

Two patients in this series chose to have the contralateral large breast reduced first and the transverse abdominal island flap reconstruction performed later to match the contralateral breast. In these two patients the final breast match was good.

Representative Cases

Other representative cases of this procedure are shown in Figures 4-20 and 4-21.

5

Bilateral Reconstruction

The transverse abdominal island flap operation is well suited for reconstructing the bilateral mastectomy defect. There are certain advantages of this technique over other procedures. First, the tissue for both breasts is taken from one abdominal wound; and second, the operation is performed with the patient in the supine position throughout the procedure. There are, however, two factors that may be considered drawbacks to the use of this procedure for bilateral reconstruction: The demands made on the surgeon are greater because the operation is longer (5 to 6 hours for a bilateral procedure in contrast to 3 to 4 hours for the unilateral repair); and in the small, thin patient, there may not be enough tissue available to rebuild two adequate breasts without the use of silicone prostheses.

The morbidity and complication rate in our bilateral series has been no greater than with unilateral reconstructions. Our illustrative case is a 53-year-old woman who had a modified radical mastectomy on the right side for lobular carcinoma in 1971 and a total mastectomy on the left side in 1974 for lobular carcinoma in situ (Figure 5-1).

Preoperative Planning

Chest

The mastectomy scar on the right side (Figure 5-2) is higher and more oblique than the scar on the left. In order to make the reconstructed breasts more symmetrical, the right chest incision was planned to match the left.

For the bilateral reconstruction, if the mastectomy scars are not at approximately the same

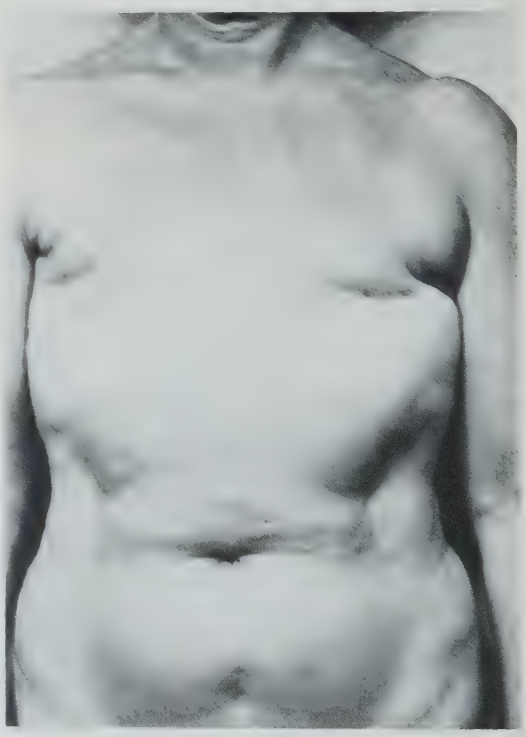
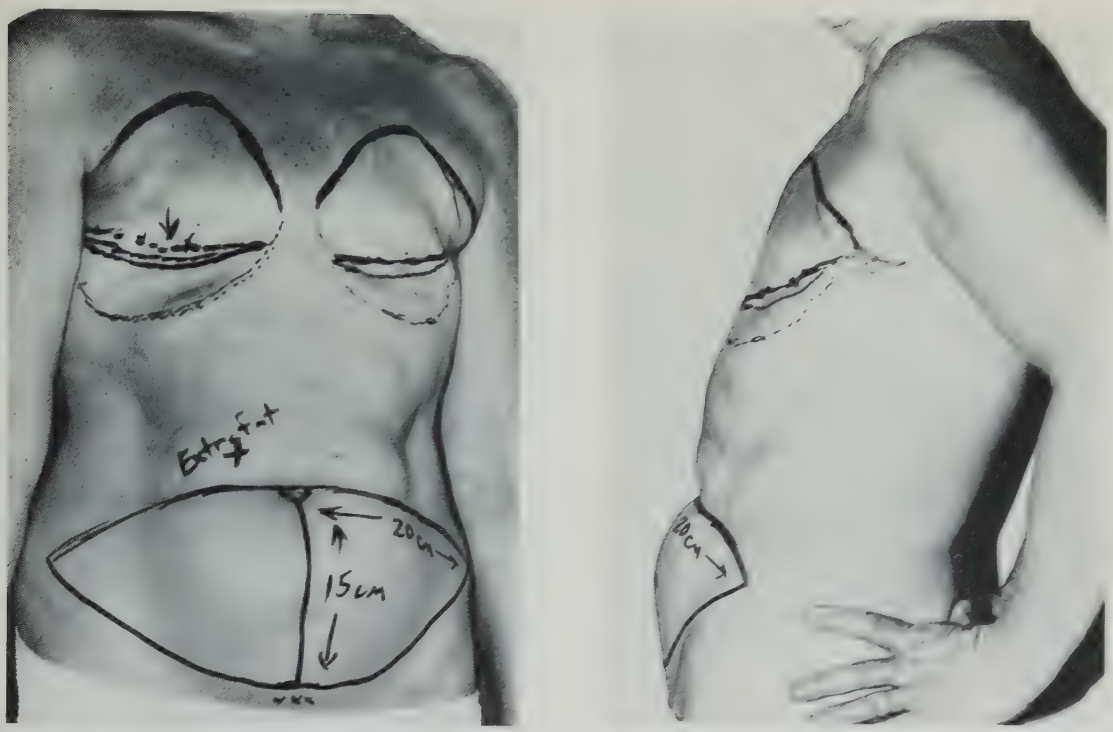


Figure 5-1 Illustrative case: bilateral mastectomy (modified radical mastectomy on the right, total mastectomy on the left).



A B

Figure 5-2 A,B: Preoperative planning for bilateral reconstruction using the TAIF procedure.

level or if they are oriented in dissimilar directions, it is best to ignore one or both scars and design new incision lines that will be similar. This avoids contrast in color, skin texture, and scar direction on the two breasts.

The extent of the original breast extirpation was marked on both sides as described in Chapter 3. In this case, more tissue is needed on the right (the side of the modified radical mastectomy) to make the two new breasts the same size.

Abdomen

All of the abdominal tissue that can be safely harvested is needed to make two adequate breasts for this woman who is 5 feet 4 inches tall and weighs 146 pounds. The lower abdominal ellipse is marked as in the unilateral reconstruction (Chapter 3). The superior limits of the flap are drawn just above the umbilicus and the inferior limits above the suprapubic crease; these limits are extended to meet just below the anterior superior iliac spine on both sides. In order to provide the tissue volume needed in the right flap in this patient, additional fat was taken on the right side above the skin island. This was accomplished by beveling the incision into the fat away from the skin island and toward the epigastrium

Operative Procedure

Chest

The mastectomy scar is excised on the left chest; but the scar on the right side is ignored, and the incision is designed to match the mastectomy scar on the left side. Chest skin flaps are elevated to the limits of the mastectomy, as in Chapter 3. The important inframammary adhesion is not disturbed on either side. A tunnel is dissected from the medial breast pocket on both sides into the lower sternal area to join a common channel through the epigastrium, connecting with the

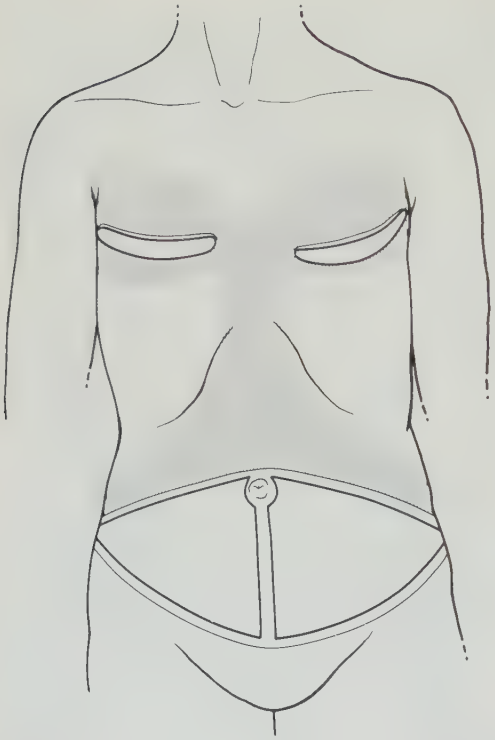


Figure 5-3 Common epigastric tunnel dissection (*shaded area*) used in bilateral reconstruction. Note that the inframammary area is not disturbed.

Figure 5-4 The transverse abdominal flap is split in the midline and elevated on two vascular pedicles. Note that the split abdominal flap provides two triangular flaps for the bilateral reconstruction.

lower abdominal incision (Figure 5-3). This skin adhesion in the sternal area is carefully preserved as low as possible to save the lower intercostal vascular perforators and to give cleavage to the new breast.

Abdomen

The abdominal flaps are elevated in the same manner as in the unilateral reconstruction (see Chapter 3) except that the vascular pedicle is preserved on both sides and the transverse abdominal island flap is split in the midline (Figure 5-4). With the bilateral reconstruction, it is even more important to preserve the rectus muscle and anterior rectus sheath laterally, along with a healthy triangle of muscle medially, from the tendinous inscription near the umbilicus to the arcuate line. A good cuff of anterior sheath must be preserved on both sides of the umbilicus (Figure 5-5). With this method of harvesting the bilateral vascular pedicle, direct closure of the anterior sheath should be possible in most cases.

After one side of the abdominal flap is elevated, it is passed through the common epigastric tunnel into the ipsilateral breast pocket before the other vascular pedicle is isolated (Figure 5-6). **The transverse abdominal island flap improves in color and warmth immediately on being placed in the breast pocket because of improved venous drainage and tissue profusion in this elevated position.**

The rectus muscle and anterior rectus sheath closure (Figures 5-7 through 5-9) is accomplished on each side as in the unilateral reconstruction (see Chapter 3). The two sides should be closed simultaneously to prevent an overcorrection on one side that will make closing the opposite side difficult. By placing several sutures through the anterior sheath before the continuous suture is tightened, gradual closure of both sides can be accomplished. If the first row of continuous sutures does not effect a snug closure of the sheath,

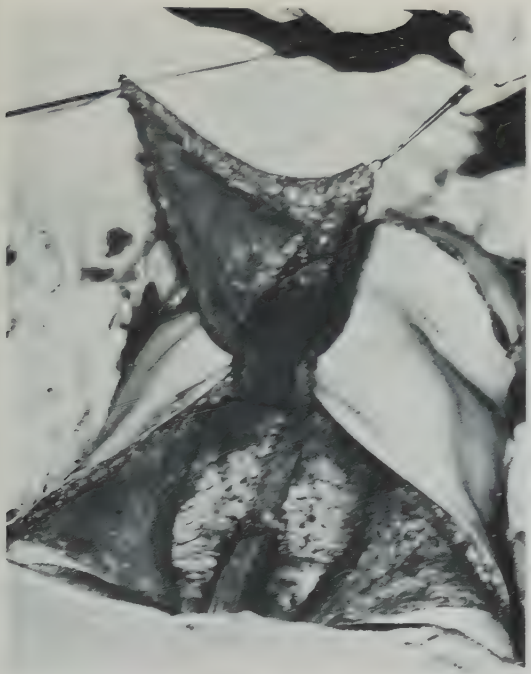


Figure 5-5 The anterior rectus sheath and muscle are preserved the full length laterally and medially from the tendinous inscription of the umbilicus to the arcuate line. A cuff of sheath is left on both sides medially from the umbilicus to the epigastrium. This muscle- and sheath-saving maneuver provides for a secure primary abdominal wall closure in the majority of bilateral reconstructions.

a second or sometimes even a third row will accomplish this.

The preoperative preparation of the bowel is important in facilitating the abdominal closure. The preoperative regimen is: liquid diet for the 24 hours before surgery, caster oil the evening before surgery, and an enema the morning of surgery. These steps along with a selective bilateral vascular pedicle harvest (preserving the anterior sheath medially and laterally) should make direct closure possible in most cases. Good anesthetic management is also important. The patient's stomach and bowel must not be allowed to fill with gas during the procedure. Complete muscle relaxation is essential during the abdominal wall repair, and the patient must not strain or wretch on, before, or after extubation.

Figure 5-6 One flap is passed through the common tunnel into the ipsilateral breast pocket before the other vascular pedicle is isolated.

This patient and another with bilateral reconstruction are shown in Figures 5-10 and 5-11.

Synthetic mesh material to reinforce the abdominal wall closure has been used in five of 27 bilateral reconstructions. If the repair is unusually tight and a competent closure seems impossible to achieve, the best possible direct repair should be accomplished first by the method previously described, and then the closure can be reinforced with an overlay of synthetic mesh. Prolene or Marlex mesh is applied over the suture closure beginning on each side in an area of strong tissue and extending to the region of good suture repair above and below. The mesh material is then evenly sutured around the periphery with interrupted and continued permanent sutures (Figure 5-12).

Synthetic mesh should not be used on the posterior sheath or below the anterior sheath closure. If the area below the arcuate line is inadvertently disrupted or the linea alba or the linea semilunaris is divided, a competent repair of these structures will be difficult to impossible. In these unfortunate cases, all the synthetic mesh material in the world may not prevent

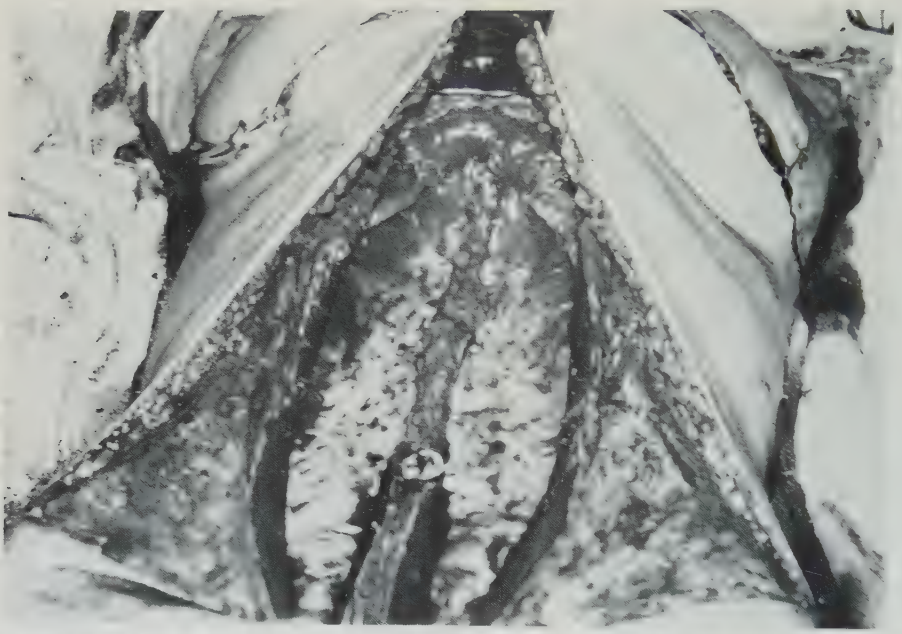


Figure 5-7 The abdomen before repair of the vascular pedicle defects

Figure 5-8 The rectus muscle has been repaired from the region of the arcuate line below to the tendinous inscription near the umbilicus.

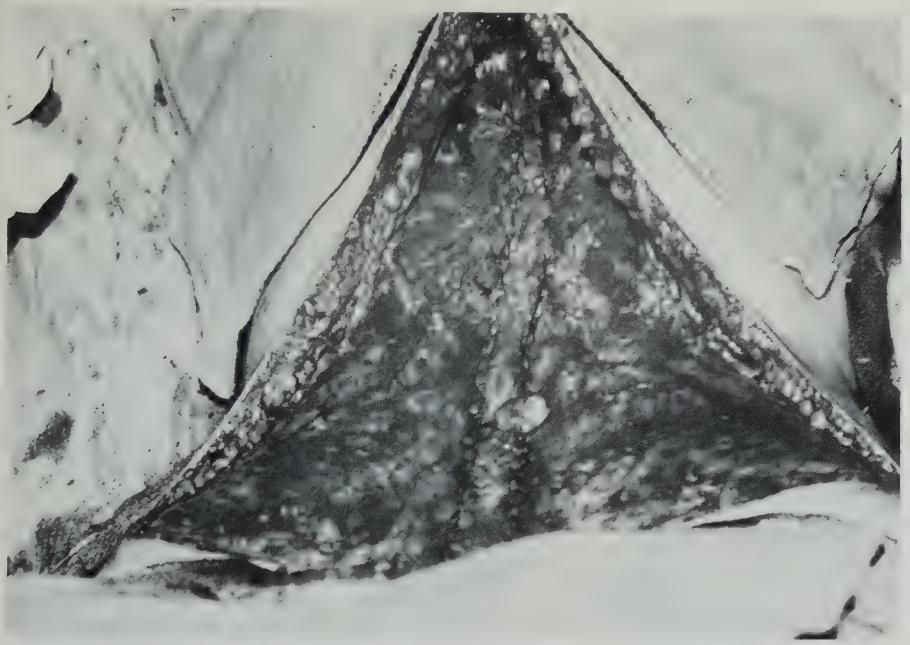


Figure 5-9 The anterior rectus sheath has been repaired with two layers of No. 1 nylon sutures on each side.

abdominal weakness or frank hernia. Fascia lata, relaxing incisions, or turnover flaps to aid in closure are not recommended.

Shaping the Breast

The abdominal flaps are secured to the upper limits of the mastectomy pocket as described in the unilateral reconstruction in Chapters 3 and 4. In the bilateral case, there is less tissue available to each side to obtain adequate size and projection. There is no "inferior wing" of the flap to turn under the lower outer quadrant.

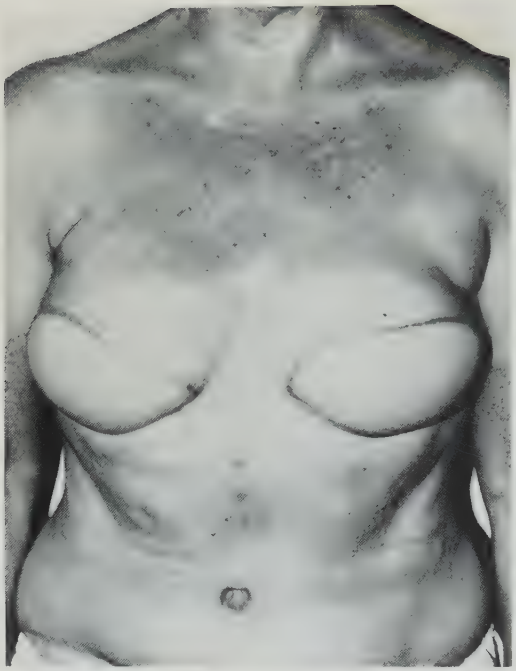
During the bilateral reconstruction, it is important to get the upper attachment of the flap and the inframammary crease at the same level on both sides and to try to achieve equal size in the two breasts. With bilateral reconstruction, the new breast may have an inferior border that appears straight without the natural roundness of the normal breast. This occurs if the lower outer corner of the triangular abdominal flaps are not rounded off either by turning them under the center of the breast or by shaping this tissue with the breast pocket and the skin brassiere. Where there is an abundance of tissue, the medial and lateral corners can be trimmed away.

In some cases a small silicone implant can be inserted under the flap as a secondary procedure to equalize the two sides or to enlarge the breasts bilaterally. In our series of 27 bilateral reconstructions, small implants were used in three patients to augment the size of both breasts; in one patient an implant was used on one side to equalize the size of the breasts.

Mastectomy of the Contralateral (At Risk) Breast

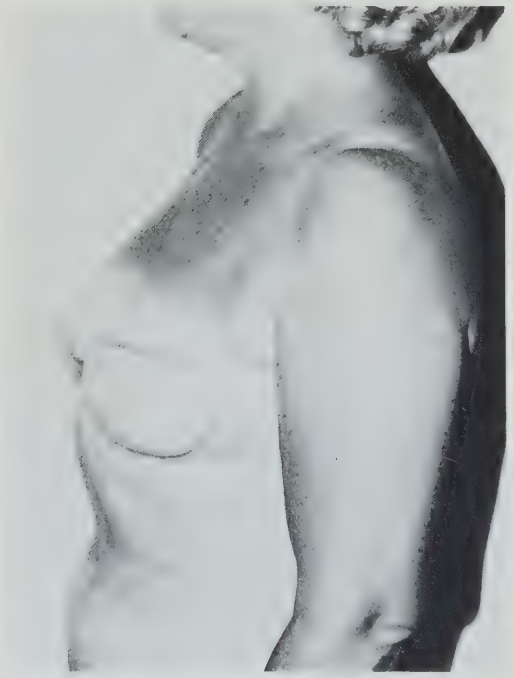
The patient at high risk for the development of breast cancer in the contralateral breast may request removal of that breast followed by a bilateral reconstruction. The advantages of this procedure, when properly performed with no postoperative problems, are obvious. The drawbacks of combining these two procedures are:

1. There are flaws in the subcutaneous mastectomy operation as a prophylactic measure against breast cancer.



A

B



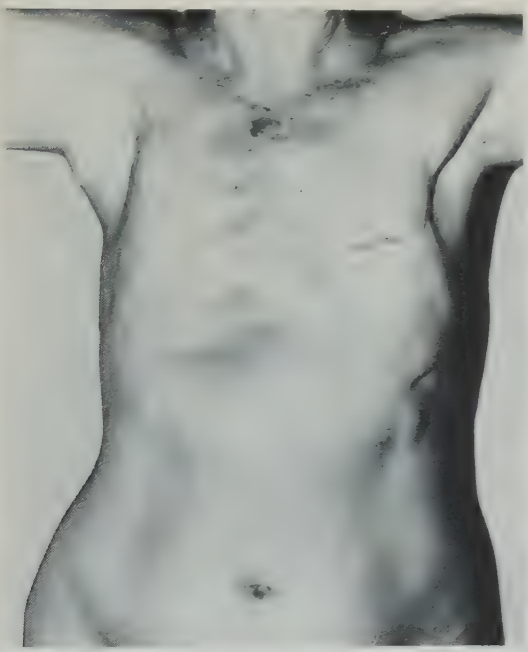
C

Figure 5-10 A–C: Illustrative case 4 months after bilateral reconstruction (no prosthesis used).

2. There is an increased length of surgery (mastectomy plus bilateral breast reconstruction) with associated possible increased risks.
3. The tissue that could be used for an adequate unilateral reconstruction must be divided between two breasts (this presents a problem, especially in the thin woman).

Twelve patients in this series chose the contralateral mastectomy followed by bilateral breast breast reconstruction. Ten patients underwent a subcutaneous mastectomy on the contralateral breast and two with a very large dependent breast had a total mastectomy on that side.

In the early part of this experience, the contralateral mastectomy was performed at the same operative session as the breast reconstruction. However, the length of the procedure and the occurrence of two complications (see Chapter 7) has changed that routine, and the contralateral mastectomy is now performed 48 to 72 hours before the bilateral breast reconstruction. There



A

B

C

D

Figure 5-11 Another bilateral mastectomy patient (radical mastectomy on the right, modified radical mastectomy on the left) before surgery (**A,C**) and 3 months after reconstruction (**B,D**) (no prostheses used).

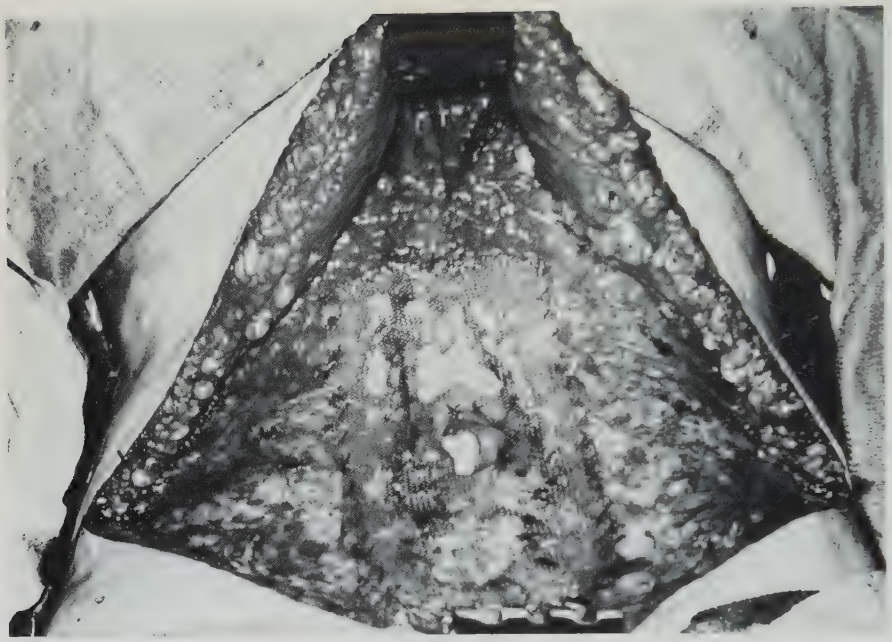
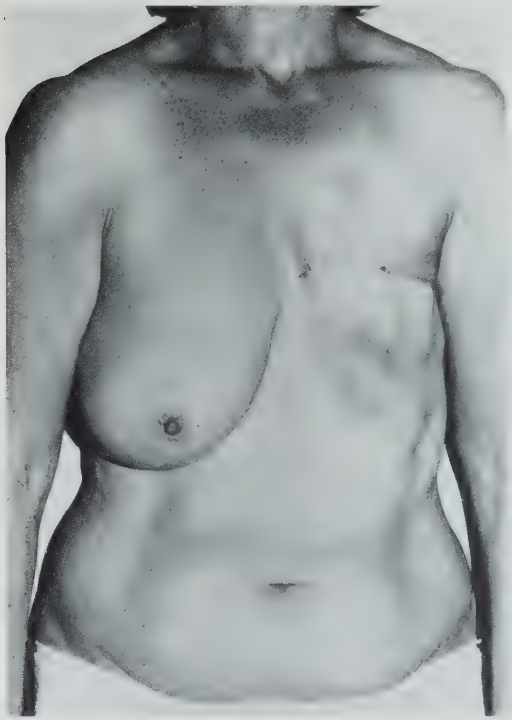


Figure 5-12 A Prolene mesh reinforcing patch is used in this bilateral reconstruction. The mesh is sewn over the anterior sheath to secure the inadequate primary repair.



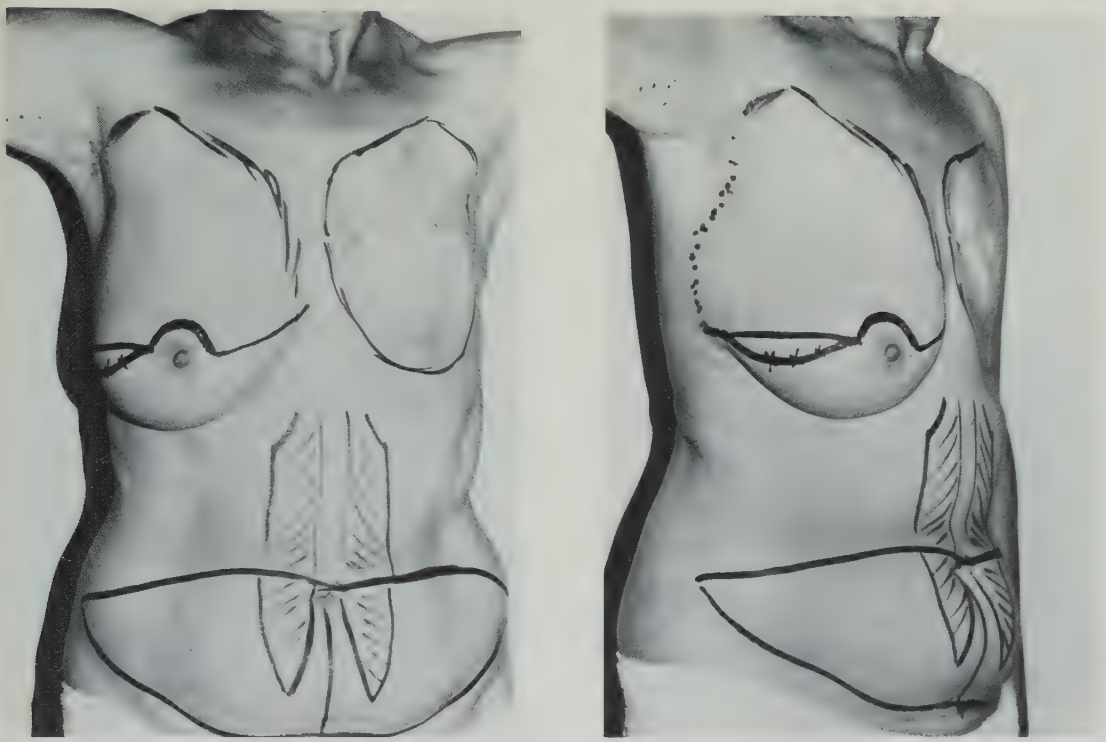
have been no problems when the operations are staged in this manner.

The subcutaneous mastectomy should be performed through a lateral nipple-areolar splitting incision (Figures 5-13 through 5-15). If there are biopsy scars on the breast, their effect on the blood supply to the skin and nipple area should be considered in the planning of the mastectomy incision.

A long inframammary incision extending far medially should be avoided when performing the subcutaneous mastectomy. Two patients experienced skin loss (one under the contralateral breast and one in the epigastrium) because of a compromise of the skin vasculature from the combination of the submammary incisions with extensive epigastric undermining. Large constant-suction drains are necessary in these women after subcutaneous mastectomy followed by reconstruction.

When using these abdominal flaps as vascularized fat, the skin of the flaps is removed leaving

Figure 5-13 Modified radical mastectomy patient with a large pendulous contralateral breast.



A B

Figure 5-14 Preoperative planning on the patient in Figure 5-13, outlining the extent of the mastectomy on the left and the limits of the proposed subcutaneous mastectomy on the right. Note the lateral breast incision to allow skin reduction and also to preserve inframammary blood supply to breast skin.

a dermal bed. However, if there is a deficiency of skin, as in the badly scarred breast (or if a skin monitor may be of value), some skin should be preserved on the flap at the appropriate location.

The triangular flap is placed on the chest with the lateral tip toward the axilla. Nylon suture fixation should be used to secure the dermis (or Scarpa's fascia) of the flap across the upper limits of the mastectomy defect.

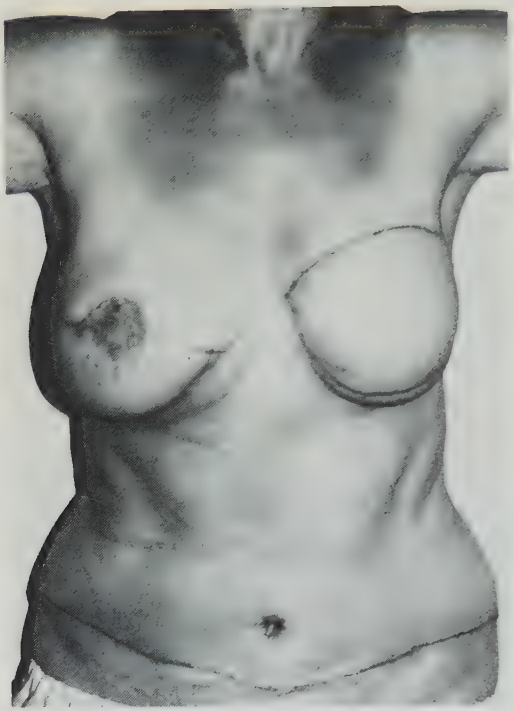
The vascularized fat cannot simply be pushed into the skin envelope as is done with a silicone implant. Fixation across the pectoral fascia at the upper limits of the new breast is important.

Shaping the vascularized fat in these cases can usually be accomplished by the skin brassiere. No fixation sutures are necessary in the lower breast area.

Monitoring the buried fat can be a problem. Confidence that the flap has a good vascular supply is reassuring, and temperature probes placed deep in the fat are helpful but not infallible. Tissue oxygen, carbon dioxide, and pH monitoring will probably be the answer in the future. At present, the most reliable way to determine the viability of the underlying tissue is by monitoring a small ellipse of skin (skin window) which remains attached to the flap and is exposed in the suture line of the new breast.

Patients undergoing bilateral reconstruction, especially those who choose to have a mastectomy on the contralateral side, need to understand that the amount of tissue on the abdomen will dictate the size of the breasts (Figure 5-16). In other words, the surgeon cannot bring additional fat to the new breasts beyond certain well-defined limits.

The woman with a large dependent breast may fare better with a total mastectomy than



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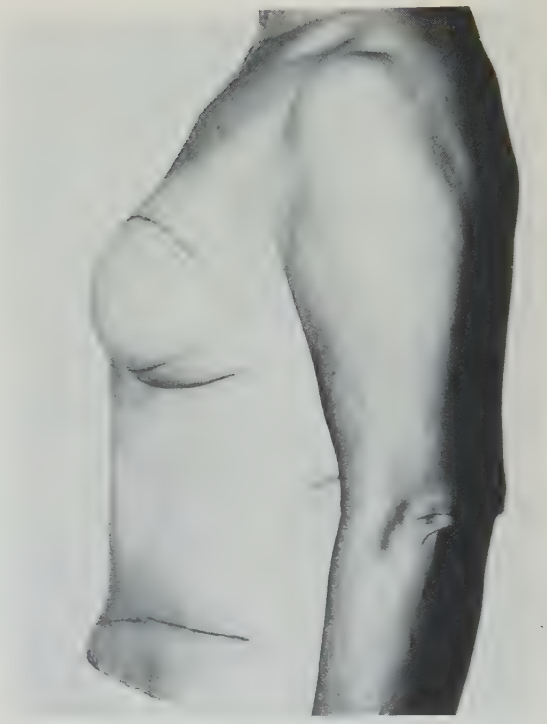

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Figure 5-15 A–C: Same patient as in Figure 5-13 and 5-14. These photographs were taken 2 months after a subcutaneous mastectomy (with skin reduction) and bilateral reconstruction (no prostheses used).

with a subcutaneous mastectomy in terms of both complete removal of breast tissue and aesthetics. If a nipple-sparing procedure is chosen, a method to reduce the amount of excess skin is necessary. Various techniques have been used, but in this operation that creates a well-vascularized breast shape (fat mound) under the skin, the nipple and areola can be centralized on this underlying fat, a moderate amount of breast skin removed, and the rest allowed to shrink with time (Figure 5-14).

Bilateral Subcutaneous Mastectomy Followed by Reconstruction with Vascularized Fat from the Lower Abdomen

Subcutaneous mastectomy with immediate or delayed reconstruction using synthetic materials has been plagued with difficulties.[41] In this series,

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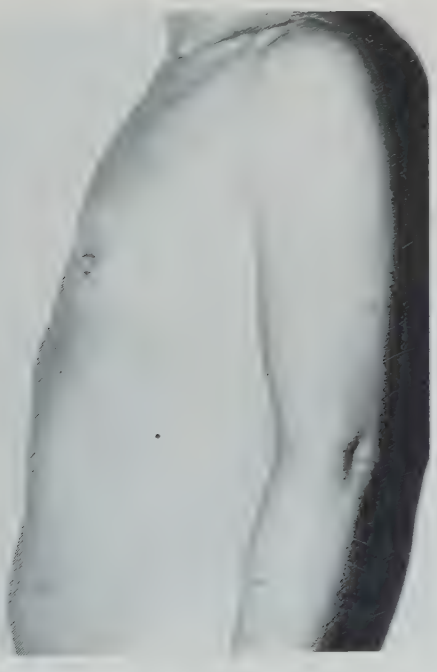

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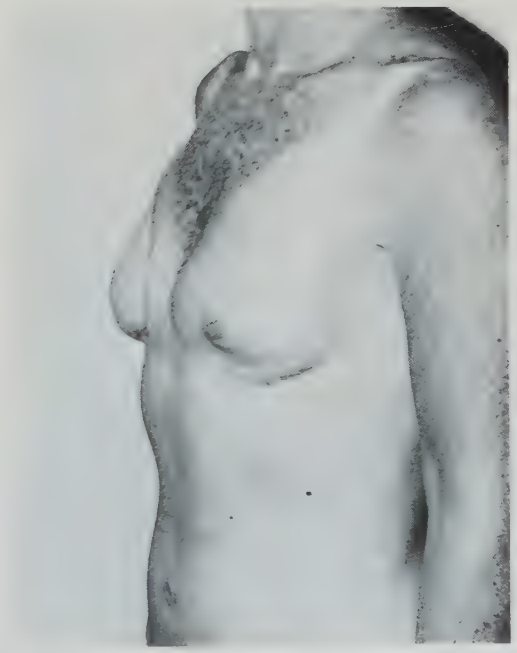

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Figure 5-16 A,C: Thin patient with a modified radical mastectomy on the right. B,D: Two months after subcutaneous mastectomy on the contralateral breast and bilateral reconstruction (no prostheses used).

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C

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Figure 5-17 A,C: This patient was at considerable risk for breast carcinoma. B,D: After bilateral subcutaneous mastectomy and reconstruction with vascularized lower abdominal fat, the breasts remain soft 2 years after surgery (no prostheses used).

two patients have had a bilateral subcutaneous mastectomy followed by breast reconstruction using vascularized fat supplied by the transverse abdominal island flap method. The results in these two women have been encouraging. In one patient the new breasts are larger than before the mastectomy, and at a 2-year follow-up they were very soft and well shaped (Figure 5-17). As with the unilateral subcutaneous mastectomy, staging of the procedure is recommended (bilateral subcutaneous mastectomy followed 48 to 72 hours later by bilateral reconstruction).

The Subcutaneous Mastectomy Cripple

The problems that are often seen after a subcutaneous mastectomy with the insertion of silicone implants include skin slough with exposure of the implant, infection with extrusion of the implant, and severe fibrous encapsulization with intractable pain. A number of operations have been proposed to correct the resulting deformities in these women. These operations include variation in type and style of the silicone implant, submuscular placement of the silicone implant, and the use of bilateral latissimus dorsi muscle flaps with implants.[36] However, using some form of foreign material as a breast expander is the common denominator in all of these methods. Most of these patients have repeatedly demonstrated an intolerance to silicone. The correction with vascularized abdominal fat avoids the use of the silicone implant and provides a completely natural-appearing breast shape that will remain soft.

The operation is performed as previously described for bilateral reconstruction. In some cases the breast is so scarred and contracted that it is necessary to use additional skin from the lower abdominal flap to expand the skin brassiere. The size and location of this added skin should be carefully planned prior to the actual surgery. Some of these "subcutaneous cripple" patients are young and do not have a great abundance of abdominal tissue; however, it is often surprising how much tissue can be harvested from even a relatively thin woman.

6

Alternatives in Abdominal Flap Design

The abdomen below the umbilicus is the most favored donor area for flaps because it provides an abundance of tissue on a long vascular pedicle that will reach any chest wall defect. However, other locations on the abdominal wall offer alternative sites for flap harvest and should be considered when abdominal scarring or other circumstances rule out the use of the lower abdomen.

Upper TAIF

The upper TAIF offers an excellent means of transferring a large amount of tissue to the chest wall and has been used successfully in reconstructing radical and modified radical mastectomies and other chest coverage problems.

The advantages to use of the upper abdominal flap are:

1. A flap that is probably more completely vascularized than the lower TAIF flap (Figure 6-1).
2. A shorter operative procedure.
3. A low postoperative morbidity rate.
4. A weakness of the lower abdomen that could occur after flap harvest is avoided.

The disadvantages of the upper TAIF are:

1. A shorter vascular pedicle which will require costal cartilage removal when reconstructing the higher defects in the radical mastectomy patient.
2. A mid-abdominal scar.

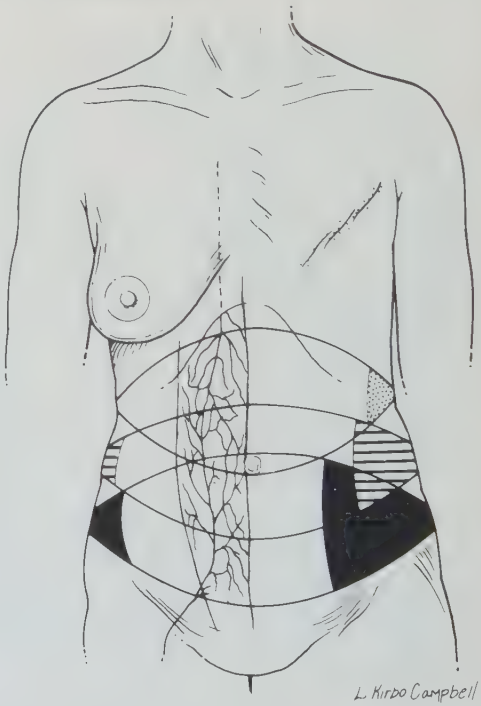

Figure 6-1 Abdominal ellipse options. The *shaded areas* of the flaps are possibly unsafe.

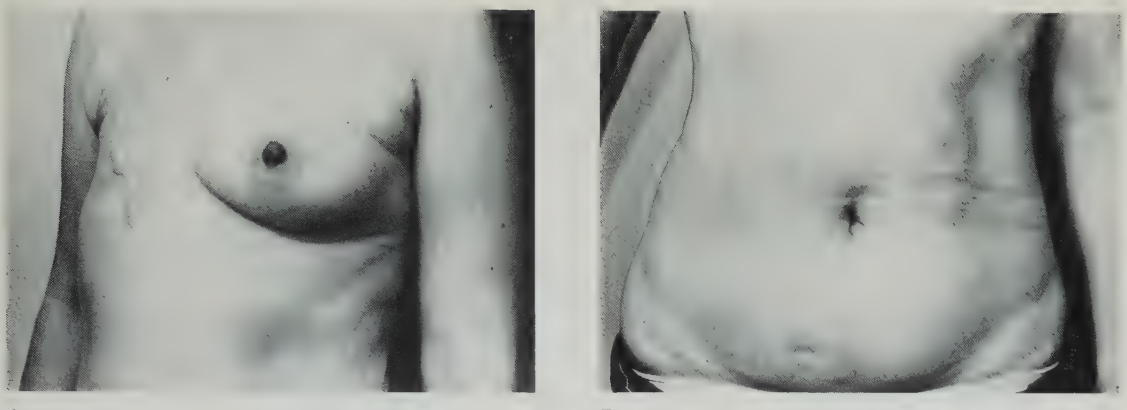

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Figure 6-2 Illustrative case. **A:** This 42-year-old woman had a modified radical mastectomy. **B:** She had an abdominal scar from the umbilicus to the pubis on the right side.

Illustrative Case

A 42-year-old woman had a modified radical mastectomy, a large well-shaped left breast, and a right paramedian scar from umbilicus to pubis (Figure 6-2). A moulage of the missing breast on the right was formed to match the left breast. The volume of the moulage was 450 cc by water displacement (Figure 6-3). An upper flap was designed using the ipsilateral vascular pedicle. Note that the lower margin of the flap included the upper periumbilical perforators.

The ipsilateral vascular pedicle is used in most upper TAIF patients because it is the most

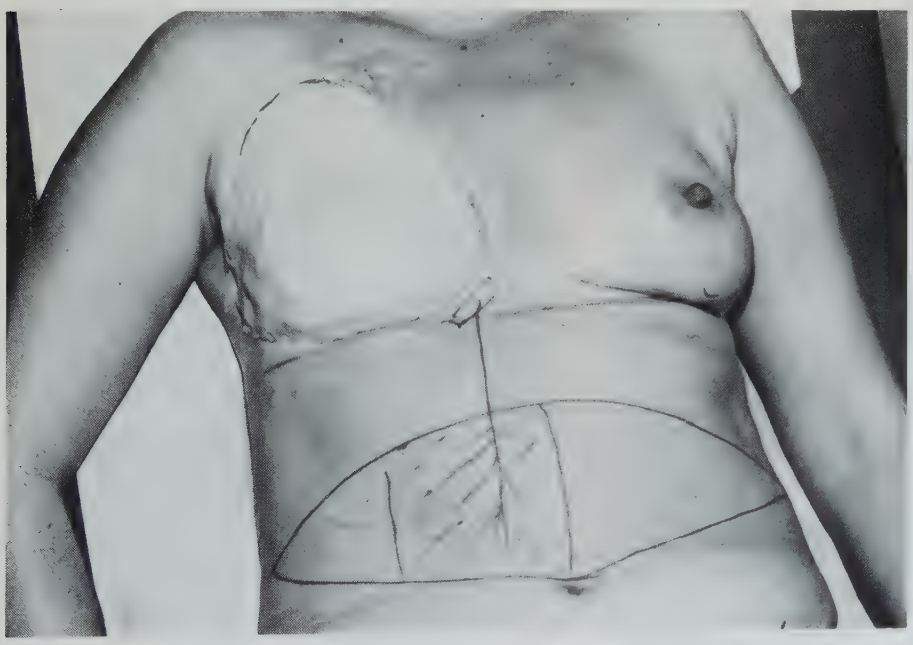


Figure 6-3 Design of the upper TAIF on an ipsilateral vascular pedicle. Moulage was used to match the left breast (450 cc volume).

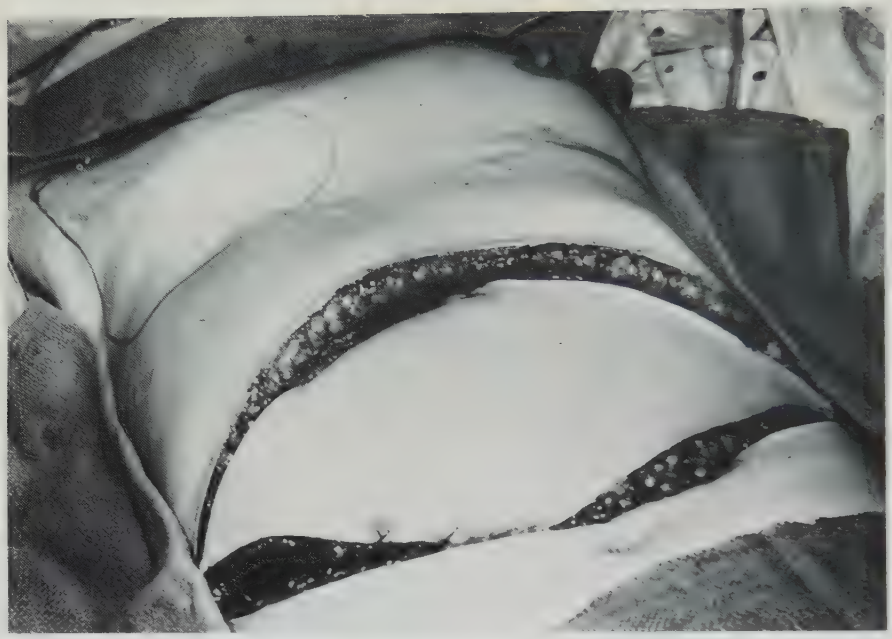


Figure 6-4 Upper TAIF elevated.

direct route to that side of the chest, giving sufficient pedicle length to reach the axilla and to shape the breast in most cases.

The mastectomy scar is incised and the breast pocket is dissected in the same manner as described in Chapter 3. The upper abdominal flap is elevated (Figure 6-4) as described for the lower flap in Chapter 3 except that the rectus muscle is transected just below the umbilicus. A lateral segment of rectus muscle is preserved along with a medial and lateral cuff of rectus sheath. A segment of the cartilaginous rib margin is removed to gain the vascular pedicle length necessary to reach the axilla in this reconstruction.

The flap is passed into the breast pocket (Figure 6-5). The ipsilateral wing of the flap (on the right side in this patient) is passed through the tunnel first and is placed in the upper part of the breast pocket toward the axilla. This rotates the flap 90 degrees (in this case clockwise) on the chest in preparation for shaping the breast. At this point the abdominal wall repair is completed before proceeding with breast shaping.

Figure 6-5 Flap positioned on the chest and rotated clockwise.

The anterior rectus sheath is closed with a double layer of a continuous No. 1 nylon suture. The breast shaping process can now be performed exactly as described in Chapter 3 for modified radical mastectomy reconstruction.

One of the most significant advantages of the upper and lower TAIF procedure is the long and flexible vascular pedicle which allows great latitude in positioning the flap on the chest. This factor makes it possible to shape the abdominal fat into a near-normal breast shape, as demonstrated in the illustrative case (Figure 6-6). This important advantage is lost if the vascular pedicle is too short. If a short pedicle is stretched in an attempt to reach the upper axilla or when shaping the breast, the vascular perfusion and venous drainage of the flap will be jeopardized.

It is a serious error in the performance of this operation to stretch the vascular pedicle to gain length. The perfusion and venous return is definitely compromised by any tension on the pedicle. If the pedicle length is inadequate, the surgeon should not hesitate to resect small segments of cartilaginous rib to gain the needed length. Although this may appear to be a radical and difficult maneuver, it is a simple matter to remove one or two segments of cartilaginous ribs (2 to 3 cm of length) over the internal thoracic vessels. The rib segment can be removed by cutting the anterior perichondrium and removing the rib with a knife and rongeur. The posterior perichondrium is then carefully incised, exposing the underlying internal thoracic vessels. The intercostal vessels are divided and controlled with vascular clips. Such a maneuver has been necessary in six of 12 upper TAIF patients. Four of these six patients underwent reconstruction for radical mastectomy.

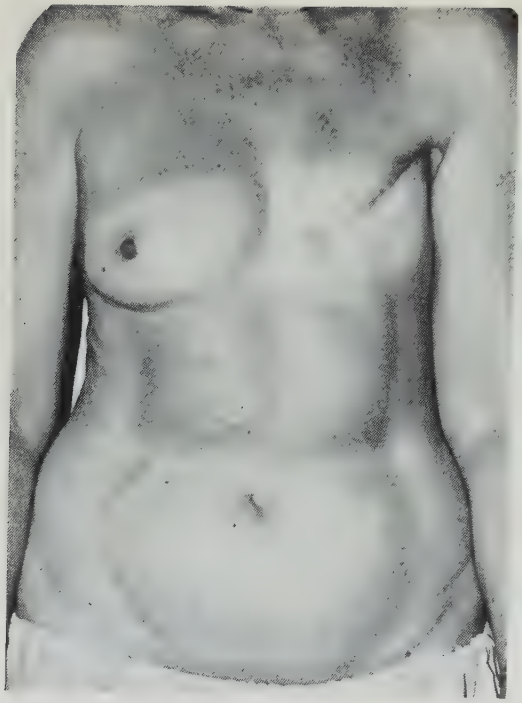
Figure 6-6 Illustrative case after reconstruction with an upper TAIF.

Indications for Use of the Upper TAIF

1. A radical mastectomy problem with scarring below the umbilicus that will prevent the harvest of a full-length well-vascularized flap.
2. A modified radical mastectomy patient with lower abdominal scarring (usually on the midline) that will interfere with the harvest of enough tissue to match the opposite breast when that is desirable.
3. The patient with the potential for lower abdominal weakness (older patient with attenuated tissue and multiple scars with denervated muscle).
4. Open chest wall defects, e.g., an irradiation ulcer that requires well-vascularized tissue, with low postoperative morbidity.

Scarred Abdomen

Abdominal scarring per se is not a contraindication to the use of a TAIF. Most abdominal scars can be avoided by planning the TAIF so as to provide an undamaged major vascular pedicle and a flap without the scars that could interfere with the blood supply to the distal tissue. The judgment and skills required in the planning necessary to avoid the effects of abdominal scars is a stimulating and challenging exercise for the reconstructive surgeon.



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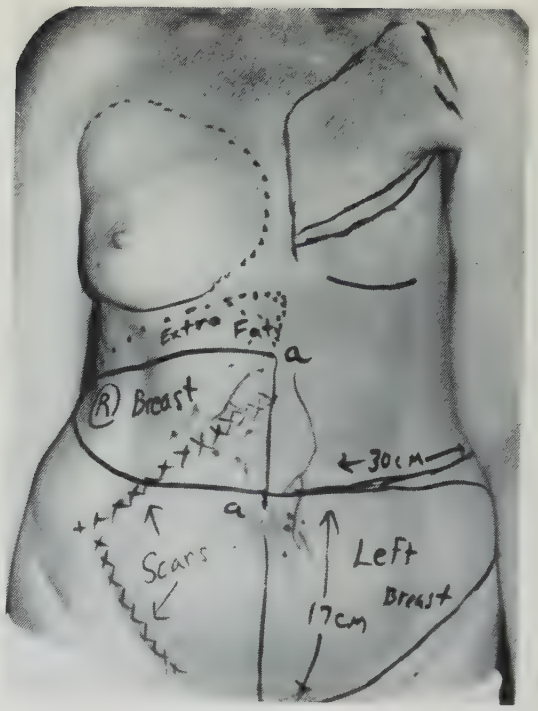

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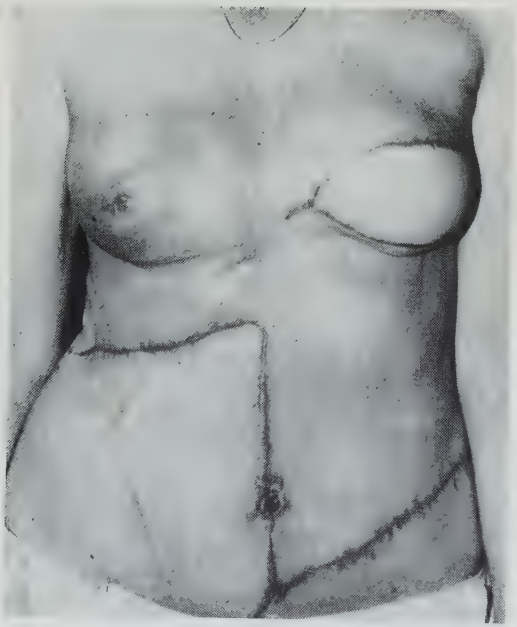

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Figure 6-7 **A:** Patient with a left modified radical mastectomy and a right breast at increased risk for carcinoma. **B:** Right subcostal scar and large appendectomy scar influence the design of a high upper TAIF to reconstruct the right breast and a lower TAIF for the left breast. **C and D:** Same patient 3 months after a subcutaneous mastectomy on the right side with bilateral reconstruction.

Abdominal Operations Contraindicating the Use of the TAIF

- Bilateral high subcostal incision (or the unilateral subcostal incision of the bilateral mastectomy)
- Standard aesthetic abdominoplasty (with disruption of the periumbilical perforators)
- Any abdominal procedure requiring elevation of the periumbilical fat with total disruption of the vascular perforators

Common Abdominal Scars and TAIF Options

Right Subcostal Scar (Kocher's Incision)

Arteriograms are not worth the risk when there is a right subcostal scar, and the surgeon must assume that the right superior deep epigastric vessels have been divided.

TAIF options include the following:

For unilateral reconstruction of a modified radical and a radical mastectomy:

- Right mastectomy—use the upper or lower TAIF with a contralateral vascular pedicle.
- Left mastectomy—use the upper or lower TAIF with an ipsilateral vascular pedicle.

For bilateral reconstruction of a:

- Modified radical and radical mastectomy—use the upper bilateral TAIF. On the right side take an upper incision of flap high enough to include the large epigastric perforators (superficial superior epigastric vessels). The subcostal scar can be included in the lower portion of this flap. (Remember that in the radical reconstruction using the upper TAIF, one or two cartilaginous ribs should be resected for the pedicle length to reach the upper limits of the mastectomy defect.)

A combination of one upper and one lower TAIF was used for a bilateral reconstruction in two patients (Figure 6-7). The disadvantage to this procedure is that postoperatively there is an asymmetrical distribution of abdominal tissue with a large Z scar on the abdomen. If possible, both flaps should be taken from the same level on the abdomen.

Microvascular free transfer of a lower TAIF on the inferior deep epigastric artery and veins may be an option on one side in some bilateral cases with the use of a conventional lower TAIF on the other side.

Upper abdominal incisions that cross the midline (dividing both rectus muscles) can present a problem in both unilateral and bilateral reconstructions (Figure 6-8). A single or double TAIF may be employed if the scar is low enough to allow the important epigastric vascular perforators to be fed by the superior deep epigastric system.

In the very high TAIF it will not be possible to take the periumbilical perforators. Therefore the high epigastric perforators (superior superficial epigastric vessels[22] must be taken to ensure a healthy flap (see Chapter 1).

Upper Midline Scar (Xiphoid to Umbilicus)

In patients with an upper midline scar the TAIF options are as follows. For unilateral reconstruction of a:

- Modified radical mastectomy (right or left)—use the lower TAIF; the upper TAIF is used rarely when breasts are small and tissue is plentiful.
- Radical mastectomy (right or left)—use the lower TAIF.

For bilateral reconstruction of a:

- Modified radical and radical mastectomy—use the upper (Figure 6-9) or the lower TAIF.

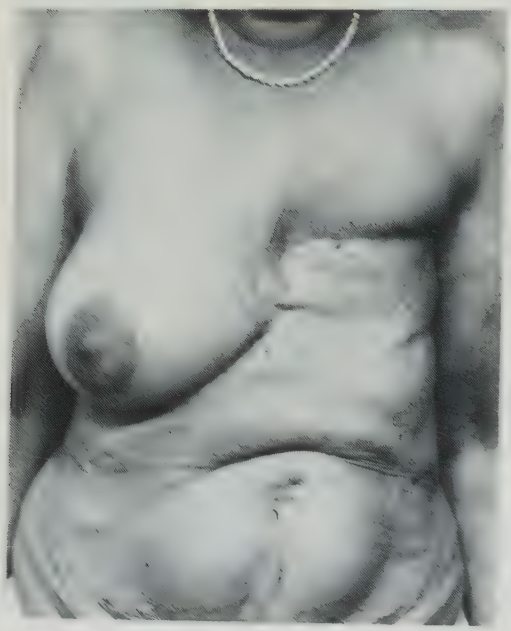
Lower Midline Scar (Umbilicus to Pubis)

With a lower midline scar, the TAIF options are as follows. For unilateral reconstruction of a:

- Modified radical mastectomy (right or left)—use the upper TAIF when much tissue is needed or the lower TAIF when little tissue needed (Figure 6-10).
- Radical mastectomy (right or left)—use an upper TAIF in most cases; use a lower TAIF with a double pedicle when much tissue needed (well vascularized throughout).

For bilateral reconstruction of a:

- Modified and radical mastectomy—use the lower TAIF.



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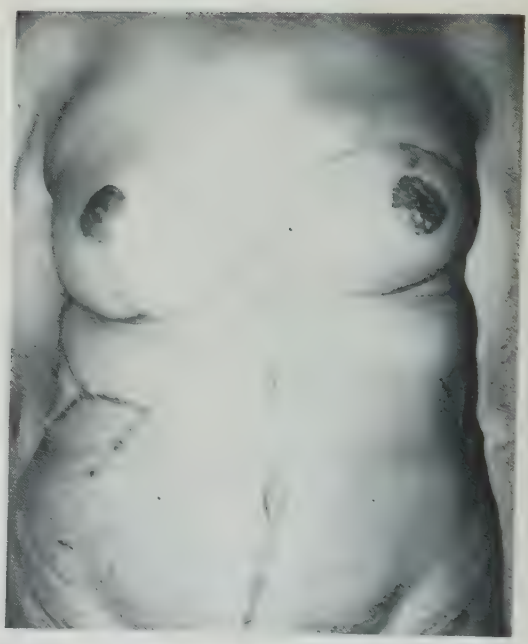

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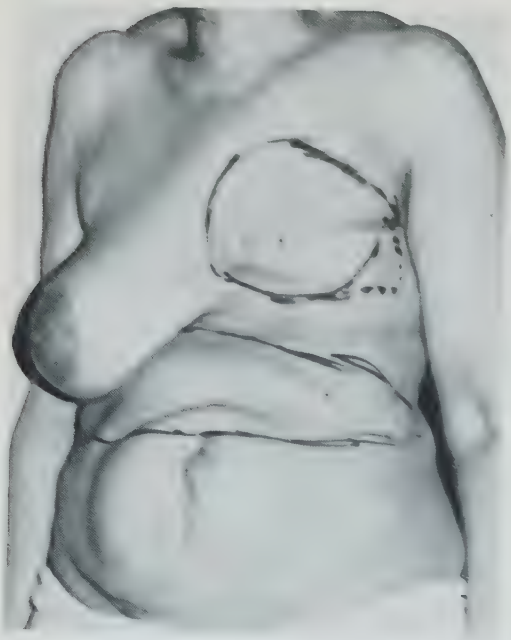

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Figure 6-8 A: This 71-year-old woman had had a modified radical mastectomy and extensive abdominal scarring. A subcostal scar divides both rectus muscles. The TAIF was designed high to include the large epigastric perforators. B and C: The patient had a hospital stay of only 5 days for the reconstruction with a satisfactory new breast.

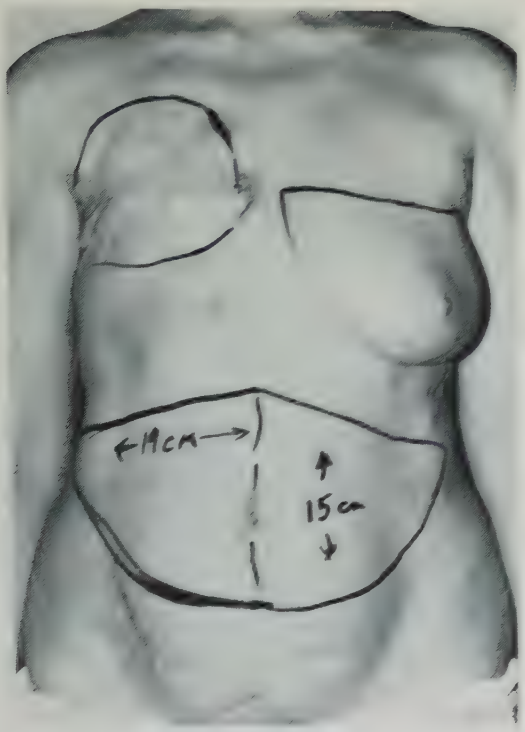

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Figure 6-9 A: This patient with a modified radical mastectomy on the right. The left breast is at increased risk for Ca. She had had 13 major abdominal operations in the past. A TAIF was designed in the mid-abdomen to avoid the lower abdominal scarring and to include the upper midline scar. B: The same patient after total mastectomy on the left and bilateral reconstruction.

Appendectomy Scar (McBurney)

There is great variation in length and location of appendectomy (right lower quadrant) scars (Figures 6-7 and 6-11). TAIF options in these cases include the following. For unilateral reconstruction of a:

- Modified radical right mastectomy—use the lower TAIF contralateral pedicle.
- Modified radical left mastectomy—use the lower TAIF ipsilateral pedicle.
- Radical mastectomy—same as with the modified radical except when there is a right lower quadrant scar and significant restriction of tissue harvest on that side the TAIF must be taken higher on the abdomen (Figure 6-11).

For bilateral reconstruction of a:

- Modified and radical mastectomy—use a TAIF taken higher on the abdomen to get adequate well-vascularized tissue in most cases (Figure 6-9).

Lateral Rectus Incisions

Lateral rectus incisions are hazardous to the TAIF in two ways. First, they denervate the rectus in the area medial to the incision, causing atrophy of the muscle. When these incisions occur in the upper abdomen, the pedicle on that side is nothing more than thin areolar tissue containing the epigastric vessels. In the lower abdomen they effectively weaken the abdominal wall on that side, so that even when using the opposite pedicle lower abdominal weakness could develop. Second, the tissue lateral to these

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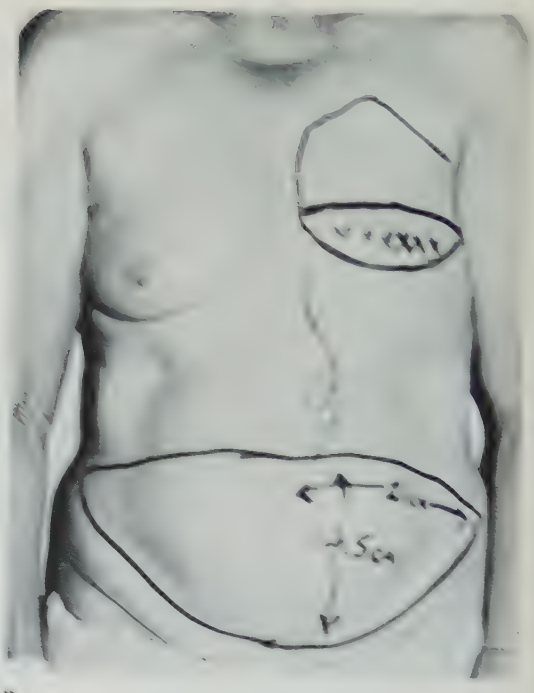

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Figure 8-10 A: Patient with a left modified radical mastectomy and a lower midline scar. B: The TAIF was designed to use one-half of the lower abdomen and an ipsilateral vascular pedicle. C: Early postoperative result.

C

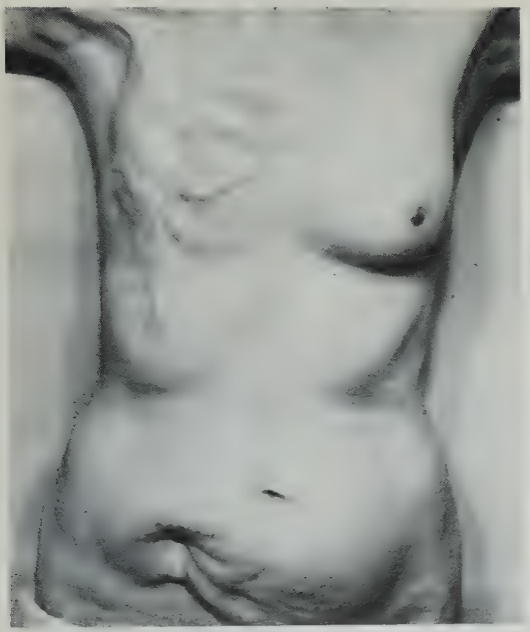
scars is devascularized when the scar is included in the TAIF.

Do not expect or depend on blood flow distal to a scar that crosses the TAIF. Reports of the occasional survival of this distal tissue are of little comfort. These scars should be planned out of the TAIF to be assured of a totally healthy flap every time.

Upper Abdominal Lateral Rectus Scar

In the presence of an upper abdominal lateral rectus scar, the TAIF options are as follows. For unilateral reconstruction of a:

- Modified radical mastectomy—use an upper or lower TAIF with a pedicle on the side contralateral to that of the scar. With an upper flap, tissue distal to scar should be discarded.



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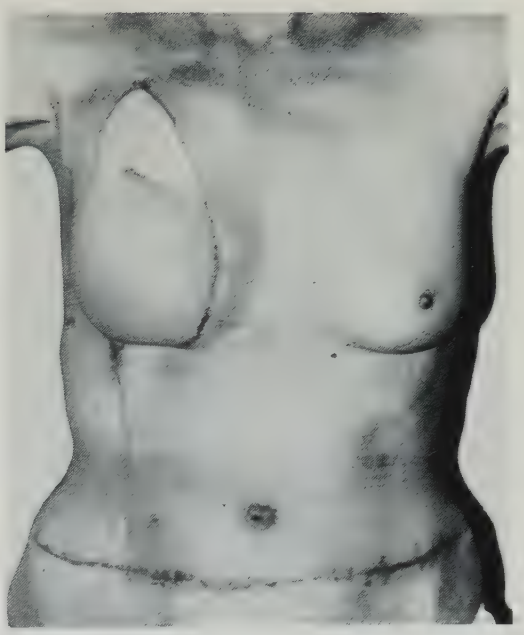

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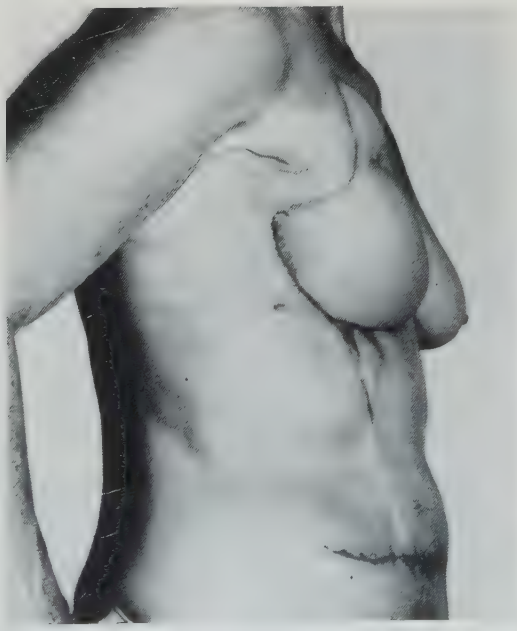

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Figure 6-11 A,C: Patient with a right radical mastectomy and a chest wall skin graft. The right lower quadrant of the abdomen is badly scarred. B,D: Same patient after reconstruction with a mid-abdominal TAIF. Note the umbilical scar in the upper part of the new breast.

- Radical mastectomy—use the lower TAIF with a pedicle on the side contralateral to that of the scar.

For bilateral reconstruction:

- An upper flap is not safe on the side of the scar; lower flaps may be possible, but elevating a vascular pedicle on the side of the scar requires delicate dissection to avoid damage to deep epigastric vessels within the atrophied muscle on that side.

Lower Abdominal Lateral Rectus Scar

When there is a lower abdominal lateral rectus scar, the TAIF options are as follows. For unilateral reconstruction of a:

- Modified and radical mastectomy (right or left)—harvest the flap above the scar (upper TAIF) to avoid weakening the lower abdomen.

For bilateral reconstruction of a:

- Modified and radical mastectomy—use an upper TAIF.

Transverse Suprapubic Scar (Pfannenstiel Incision)

A transverse suprapubic (Pfannenstiel incision) should not influence the abdominal flap design unless there is unusual extension of the abdominal wall dissection toward the umbilicus. In the standard use of this incision the dissection is not carried above the region of the arcuate line (midway between the pubis and the umbilicus). The rectus muscles are not transected but are separated in the midline to enter the peritoneum. In patients with a Pfannenstiel incision in whom the condition of the vascular perforators below the umbilicus is questionable, the flap should be taken higher on the abdomen.

When planning all transverse abdominal island flaps, keep in mind the possible influence of abdominal scars (and their deeper lateral extensions) on the critical vascular perforators of the anterior rectus sheath.

The patient with a badly scarred abdomen requires not only careful planning in the flap design but also in the rotation of the flap on the chest wall. The flap rotation and subsequent shaping of the breast in these patients may vary from the standard technique and so requires considerable forethought and study to ensure flap viability and good breast shape.

Arteriograms

Early in this series, visualization of the deep epigastric system by arteriograms was helpful in understanding the normal and abnormal hemodynamics of the TAIF (see Chapter 1). However, these arterial studies carry some morbidity and have not been needed for flap design since case 40 (Figure 6-9).

It is prudent to avoid the use of a questionable vascular pedicle when other alternatives are available. There is still an occasional patient in whom the arterial supply to the abdomen is unclear, and in these cases an arteriogram performed by direct cannulization of the internal thoracic vessels is invaluable when planning the TAIF.

Chest Wall Irradiation

With standard irradiation dosage and delivery techniques, skin changes on the chest wall should be minimal and should not be a contraindication for use of the TAIF. The contralateral pedicle has been used most often in patients with an irradiated chest. However, the ipsilateral irradiated internal thoracic vessels have also been used as the pedicle without problems. The important consideration in the irradiated patient is to use only well-vascularized flap tissue to ensure primary healing of the new breast skin edges. This may require altering the flap design and breast shaping to put reliable tissue in the irradiated area. These variations in flap design might include using only the pedicle side of the flap, harvesting the flap higher on the abdomen (upper TAIF), or in some cases using two vascular pedicles to cover one side of the chest (Figure 6-12A,B).

Double Pedicle TAIF: Illustrative Case

The overall condition of the irradiated chest wall and chest skin is improved by bringing a new blood supply to the area via the TAIF. The complication rate in the irradiated patients has been no higher than in the nonirradiated patient. Four patients with radical mastectomies and extensive

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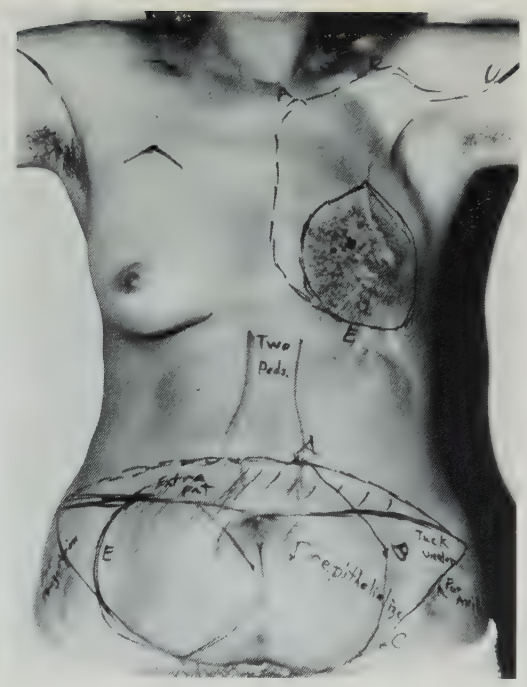

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Figure 6-12 **A:** This is a 39-year-old patient with a left radical mastectomy and extensive irradiation changes of the left chest wall (including ulceration). **B:** The lower midline scar, the extensive chest-breast defect, and heavy irradiation damage influenced the design of the large lower TAIF with a double (both deep epigastric vessels) pedicle. **C:** Postoperative view shows complete filling of the infraclavicular hollow, a nice anterior axillary fold, and replacement of the damaged chest skin.

A

B

Figure 6-13 Same patient as in Figure 6-12 before (A) and after (B) the reconstruction.

Figure 6-14 Same patient as in Figure 6-12 showing the lower TAIF with the double vascular pedicle.

Figure 6-15 Same patient as in Figure 6-12 showing passage of the large lower abdominal flap with the double pedicle into the chest-breast pocket.

chest wall irradiation damage (two with frank skin ulceration) have been successfully managed with tissue from the lower abdomen vascularized by both deep epigastric vascular systems (double pedicle). The results were exceptionally fine in these patients (Figure 6-13), and this technique is now employed more often for the extreme radical mastectomy defect with and without irradiation damage to the chest. When using two vascular pedicles for reconstruction of one side of the chest (Figure 6-14), the abdominal tissue can be transferred as a single flap (Figure 6-15), or it may be divided and used as two flaps. Two separate flaps may offer more flexibility in the positioning of tissue on the chest wall in some difficult reconstructions and chest wall coverage problems.

Thoracic and Cardiac Operations

Some thoracic and cardiac operations divide the internal thoracic vessels, and the reconstructive surgeon needs to be aware of this fact including which side and at what level. If one internal thoracic vessel has been divided, the TAIF should be based on the opposite vascular pedicle.

In one patient an upper TAIF was successfully transferred to the chest after both internal thoracic arteries had been divided at the sixth intercostal space by a recent coronary revascularization procedure (Vineberg operation). In this case the seventh, eighth, and costomarginal vessels were left intact on the pedicle side and provided adequate vascularization to the flap.

7

Complications
Analysis, Management, and Prevention

All methods of breast reconstruction available to the patient today have limitations and imperfections that should be understood and accepted as unavoidable flaws inherent to the procedure. Inherent problems with the TAIF are scarring on the breast and abdomen and prolonged abdominal healing. For the purpose of this discussion, a complication is defined as an untoward event occurring intraoperatively or postoperatively that does not fall into the category of these inherent problems.

Poor breast shape, lack of projection, and asymmetry are factors related to artistic skill, surgical technique, and experience with the procedure and are difficult to evaluate objectively. The complications discussed in this chapter are those that occurred in the author's personal series of 119 patients (Tables 7-1 and 7-2) using the transverse abdominal island flap technique from September 1980 to September 1983.

Table 7-1 146 Transverse Abdominal Island Flaps in 119 Patients (September 1980–September 1983)

Problem	No. of flaps
Modified radical mastectomy	71
Radical mastectomy	31
Subcutaneous mastectomy	24
Total mastectomy	8
Poland's syndrome	3
Congenital chest deformity	2
Silicone failure	2
Aesthetic	2
Traumatic deformity	1
Sternal wound	2
Total	146

Table 7.2 Transverse Abdominal Island Flap in 119 Patients
September 1980–September 1983

Reconstruction	No. of patients
Unilateral (single pedicle)	88
Unilateral (double pedicle)	4
Bilateral	27
Total	119

Inherent Problems

Scarring

The abdominal donor site scar can be significant in some patients, especially when the tissue harvest is great and the abdominal skin closure is tight. The scar may be red and wide, and in some individuals it may extend far laterally or high on the abdomen making it difficult to conceal, thus the abdominal donor scar is often not that of a typical abdominoplasty and should not be represented as such to the patient.

The breast scar will encircle the new breast, in most cases the exact location is dictated by the level and direction of the mastectomy scar. These scars fade with time but can be quite obvious for several years postoperatively.

Symptoms of Prolonged Abdominal Healing

Abdominal discomfort and swelling are generally the most common complaints after this operation. Most patients experience a loss of definition at the waist and suprapubic swelling. Both of these conditions return to normal or better within 6 to 12 months. General abdominal discomfort and tightness are not uncommon at 6 weeks post operation and may last 3 to 6 months. These symptoms have been relieved in some patients by Naprosyn 250 mg twice a day. With sensory reinnervation of the abdominal wall, there may be complaints of paresthesias and pain (under the ribs and in the mid abdomen and upper anterior thighs). Most patients complain very little about their abdomen after this surgery, and those who experience the symptoms noted above are generally without complaints within 1 year. It is the surgeon's responsibility to be certain that the patient thoroughly understands these inherent problems before the operation is performed.

Minor Complications

Abdominal Seroma

Postoperative seromas which required aspiration developed in eight of the 119 patients in this series. The problem was short-lived, was not incapacitating, and did not prolong abdominal healing. Three of the eight patients who formed a seroma in this series were moderately obese. Removal of the abdominal drains early (24 to 48 hours) or late (72 hours or longer) in the postoperative period does not seem to make a difference.

Firmness in the Buried Portion of the New Breast (Fat Necrosis)

The newly transferred fat undergoes a healing process that may last a year or longer. There is a general enlargement of the new breast (probably from edema) that begins soon after surgery and does not fully regress for at least 6 months. In addition, approximately 15% of the patients have areas of hardness in the buried portion of the breast that represent foci of fat necrosis. The fat necrosis is first evidenced by erythema of the overlying skin, tenderness, and local fever. This process does not respond to antibiotics, and attempts to culture an organism have been unproductive. The residual hard lump is disconcerting to the patient and to the oncologist who is following the patient for possible chest wall recurrence. Management has consisted of close observation to establish that there is gradual regression of

the lump and an awareness that the most likely diagnosis is fat necrosis. Biopsy under local anesthesia will provide a simple and direct answer when the diagnosis is in doubt. These hard masses do not show significant regression for 9 months, and a year or longer may be required for complete softening. Biopsy of these areas shows small pockets of sterile liquefied fat separated by very vascular fibrous septa. During the prolonged resolution of these firm areas, the patient can be reassured that they will become softer.

The etiology of areas of fat necrosis in the buried portions of the new breast is unclear, but they are probably the result of the poorly understood complexities of the blood supply to the panniculus of the abdominal wall. It now appears that the major fat compartment between the skin and Scarpa's fascia receives its blood supply from a subdermal plexus (see Chapter 1). Therefore in recent cases trimming and sloping of the upper portion of the breast has been accomplished by removing fat on the underside of the flap, thereby shaping it down to a well-vascularized thin dermal edge (see Chapter 3). Since this trimming technique has been employed, areas of fat necrosis have not been a problem.

Delayed Healing of the Umbilicus

In spite of all efforts to prevent delayed healing of the umbilicus, the umbilical wound still can take 4 weeks or longer to heal, sometimes resulting in a constricted and misshapen umbilicus. At present, in unilateral reconstruction the umbilicus is treated as a full-thickness graft (see Chapter 3). In bilateral reconstruction, the umbilicus is exteriorized in the midline and some fat is left with the umbilical stalk to protect its blood supply. When so treated the umbilicus usually heals perprimum.

Major Complications

Table 7-3 lists the major complications and Table 7-4 lists them by patient sequence number in this series of TAIF reconstructions. Future problems can be avoided by analyzing the errors in these patients, as evidenced by the complications that occurred early in this experience but which are no longer encountered.

Flap Loss

In no instance has there been a complete flap loss. Partial loss of the flap has occurred in four patients: two with less than 25% flap loss (Figures 7-1 and 7-2) and two with less than 15% flap loss. The last partial flap loss occurred in patient 57, and there has been no loss of flap tissue in the last 62 TAIF patients. Prevention of flap loss is discussed later in this chapter.

Abdominal Hematoma

Two patients (Nos. 56 and 79) had abdominal hematomas that required evacuation under general anesthesia. There was no residual problem in these patients. Both hematomas occurred in

Table 7-3 Complications of Transverse Abdominal Island Flap Operations in 119 Patients (September 1980–September 1983)

Complication	No.
Total flap loss	0
Partial flap loss (<25%)	4
Skin loss (other than neobreast)	1
Hematoma	2
Infection with skin loss (epigastrium)	1
Hernia	1
Fat atrophy in lateral neobreast	2
Reexploration for venous congestion	1
Total	12

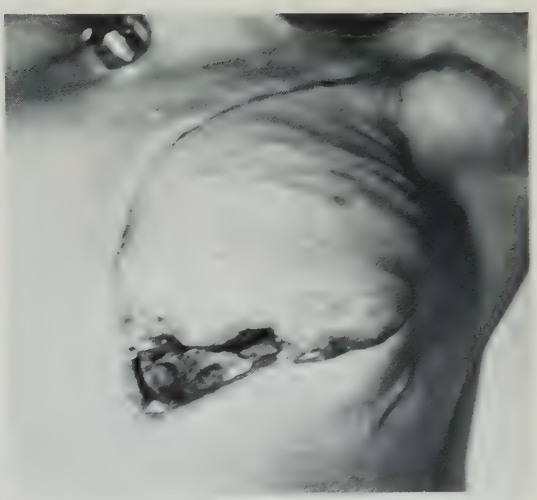
Table 7.4 Complications of TAIF Operations in 115 Patients (September 1980–September 1983)

Patient No.	Mastectomy defect	Type of TAIF	Complications	Error in				
				Patient selection	Surgical technique	Postoperative management	Remedy	Final result
13	Radical	Lower	15% flap loss	Heavy smoker	Flaps of safe length	Compliant blood loss	Secondary closure	Poor (Fig. 7.1)
14	Modified radical	Lower	Fat atrophy of lateral breast	Lax skin	Excess excision in thinning breast	Delay in early ambulation	Primary closure	Fair
16	Radical	Lower	15% flap loss	Heavy smoker, lupus	Flaps of safe length	Compliant blood loss	Secondary closure	Poor (Fig. 7.2)
22	Modified radical	Lower	Excess skin problem with reconstruction	No error	Knot in pedicle	No error	Early surgical revision	Excellent (Fig. 7.3)
28	Modified radical	Lower	Abdominal wall hernia	Obesity	Partial excision of abdomen	Delay in early ambulation and cough	Hernia repair	Good
39	Radical	Upper	15% flap loss	Smoking, abnormal scarring	Pedicle too high	No error	Massage, steroid ointment	Fair
41	Modified radical	Lower	Fat atrophy of lateral breast	Smoker, thin	Excess dermal scar by shaping	Delay in early ambulation	Primary closure	Fair
56	Modified radical	Lower	Abdominal hernia	No error	Poor haemostasis	No error	Early mobilization	Excellent
57	Modified radical	Lower	15% flap loss	No error	Excess dermal scar, possible anomaly	No error	Early surgical revision	Fair
79	Modified radical	Lower	Abdominal hernia	No error	Poor haemostasis	No error	Early surgical revision	Excellent
84	Bilateral modified radical subcutaneous	Lower	Hematoma & infection on subcutaneous side, loss of chest skin	Obesity, smoker	Poor haemostasis	Failure to recognise hematoma	Skin graft chest	Poor (Fig. 7.4)
93	Bilateral modified radical subcutaneous	Lower	Skin & nipple loss on subcutaneous side	Smoker, lupus	Large intramammary subcutaneous incisions	No error	Skin graft breast	Good (Fig. 7.5)

A

C

E

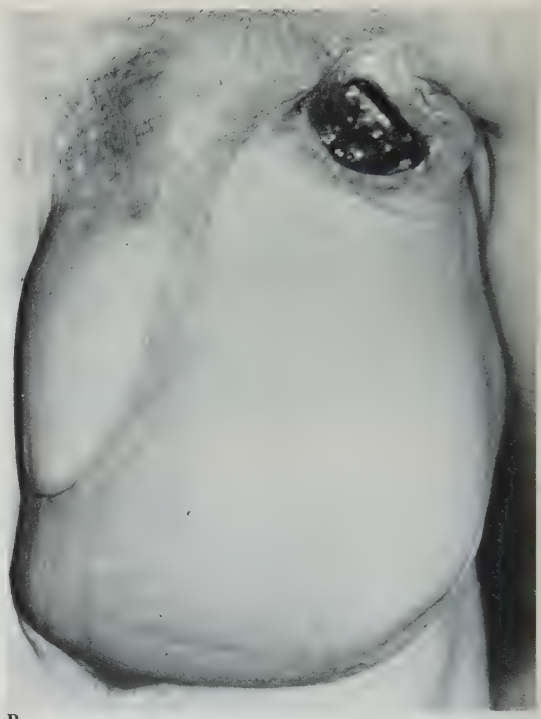


B

D

Figure 7-1 A: Patient 13 with a left radical mastectomy. B: There is loss of the lower portion of the new breast because of abuse of the safe flap limits in a heavy smoker and unreplaced blood loss. C: The same patient after debridement and closure. D: Side view of the patient before reconstruction. E: After reconstruction.

A



B

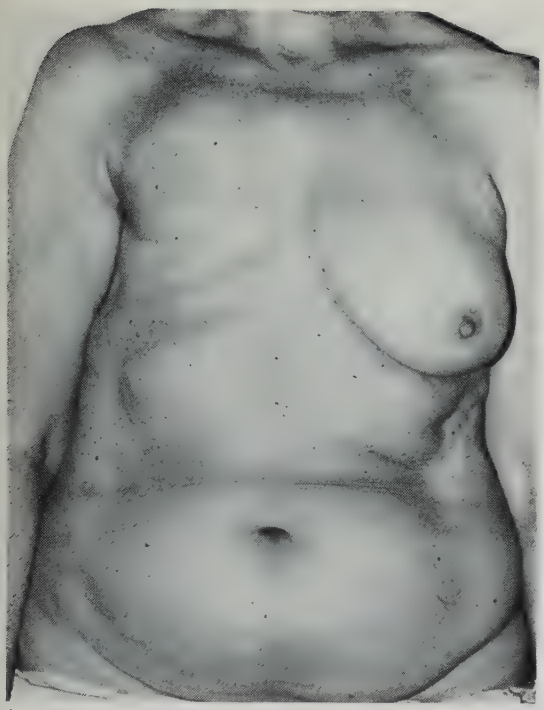
C

the epigastrium and could have been prevented by better hemostasis in the epigastric tunnel region. A third abdominal hematoma (reported as the only abdominal hernia in this series) occurred in an obese patient and was unrecognized. The bleed occurred within the repaired rectus sheath probably from a blown tie on the inferior deep epigastric vessels. These vessels are now controlled by double vascular clips, and the rectus sheath is closed with nylon sutures instead of the polyglactin or Vicryl sutures that were used in this patient.

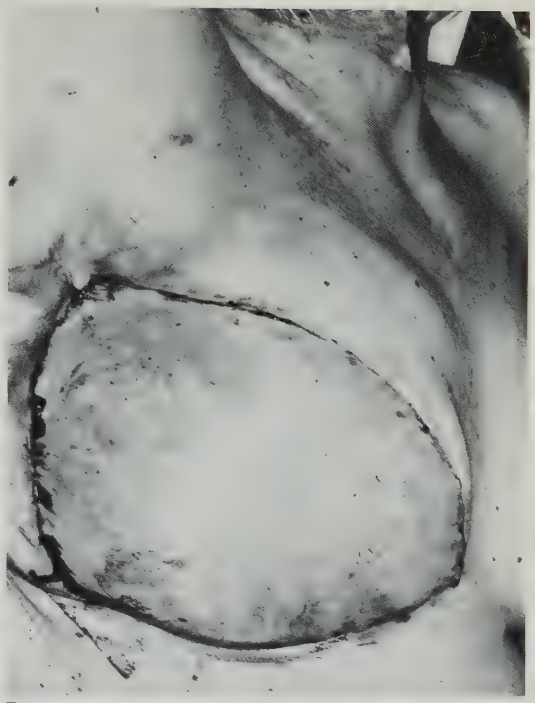
Breast Hematoma

Hematoma occurred in one breast pocket after a subcutaneous mastectomy with immediate reconstruction (patient 84). The patient was obese, and the hematoma was unrecognized, leading to

Figure 7-2 **A:** Patient 16 with a left radical mastectomy and heavy chest wall irradiation. **B:** Loss of the upper portion of the flap in the irradiated region. **C:** Closure of the chest defect with a triceps flap.



A



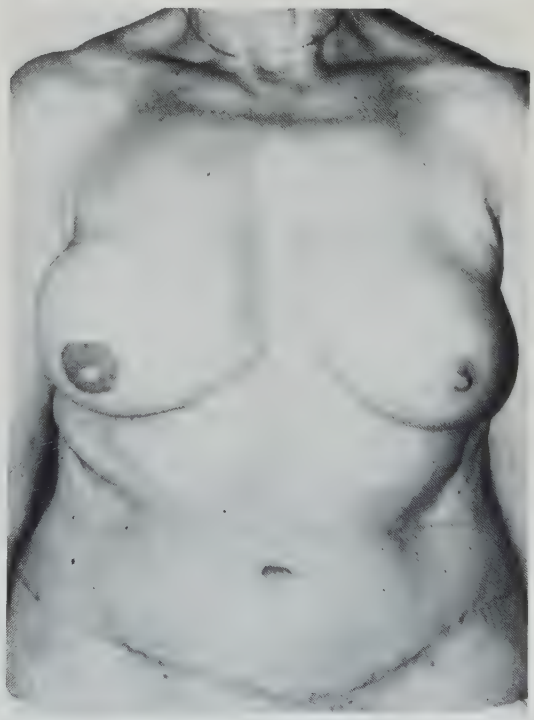
B

an infection. There was no loss of breast tissue, although some chest wall skin between the breast was lost (Figure 7-4). Subcutaneous mastectomy and breast reconstruction are no longer performed at the same operation. The breast reconstruction now follows the subcutaneous mastectomy by 48 to 72 hours (see Chapter 5).

Large constant-suction drains have been used on every case, two in the breast (one medial and one lateral) and two in the abdomen. These drains are removed within 48 to 72 hours. They obviously do not prevent a large hematoma.

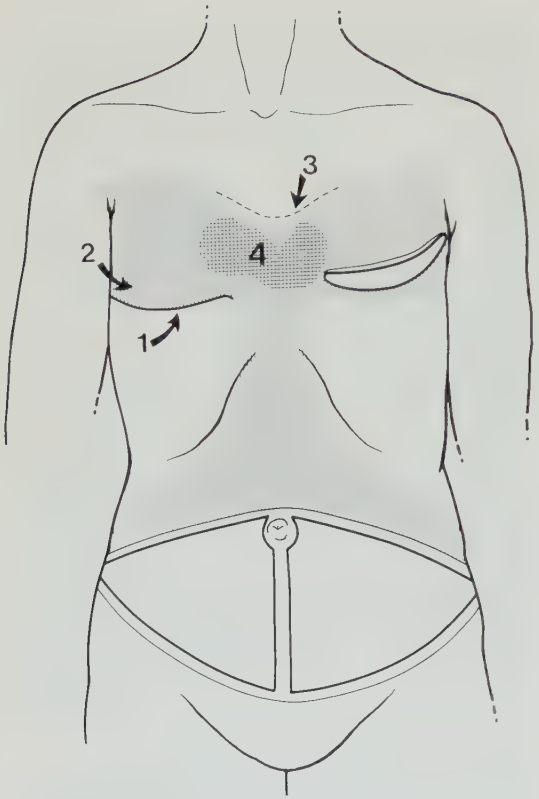
Skin Loss in the Contralateral Breast

One patient (#93, Table 7-5) lost the nipple and some lower breast skin following a subcutaneous mastectomy and immediate reconstruction.



C

Figure 7-3 **A:** Patient 22 with a right modified radical mastectomy. **B:** New breast with a mottled appearance at 6 hours after operation (the flap was also cold). Venous congestion of the new breast was corrected during the early postoperative period. **C:** The same patient 8 months after reconstruction.



A well-vascularized fat flap beneath this skin loss made possible a satisfactory salvage with a skin graft (Figure 7-5). This complication can be avoided by using a midlateral breast incision in the performance of the subcutaneous mastectomy.

Abdominal Hernia

There was one abdominal hernia in this series (patient 26). Its occurrence can be traced directly to poor patient selection and error in operative performance. The hernia has been successfully repaired with Prolene mesh.

Abdominal wall problems can be avoided if the following operative guidelines are observed.

1. The intricate support system of the anterior abdominal wall below the arcuate line should

Figure 7-4 Chest and abdominal dissection (*shaded areas*) in patient 84 with bilateral reconstruction. The subcutaneous mastectomy incision (*1*) and the extended sternal dissection (*3*) along with the usual undermining led to skin loss between the breasts (*4*). A breast pocket hematoma (*2*) further complicated the problem.

Table 7-5 Method of Abdominal Repair in 119 Patients Using the Transverse Abdominal Island Flap

Type of transverse abdominal flap	No. of patients	Direct repair	Prolene mesh repair	Other types of repair	
				Repair	No. of patients
Single pedicle					
Upper	8	6	0	No sheath repair	2
Lower	80	78 1 hernia	0	Fascia turnover (pts. 9 and 10)	2
Double pedicle					
Upper	1	1	0		0
Lower	24	18	5	Lateral relaxing incision (pt. 2)	1
Lower (Double pedicle 1 flap)	4	4	0		0
Combined upper & lower	2	2	0		0
Total	119	109	5		5

A B

Figure 7-5 A: Patient 93 with a subcutaneous mastectomy on the left followed by a bilateral breast reconstruction. A long incision in the inframammary crease on the left combined with an old biopsy scar on the left breast led to loss of the nipple and skin under the breast. Note the exposed well-vascularized abdominal fat in the left breast. B: The same patient after a skin graft to the left breast and bilateral nipple-areola reconstruction.

be left intact. This includes the pyramidalis muscle, the anterior rectus sheath, and the rectus muscle.

2. The vertical ligamentous support structures of the anterior abdominal wall (the linea alba and the linea semilunaris with their investing fascias) should not be violated.
3. The transverse ligamentous support system of the anterior abdominal wall (the tendinous inscriptions of the rectus muscles and the anterior sheath) which are necessarily interrupted during this operation should be repaired if possible in a direct fashion using nonabsorbable suture material as described in this text. For details of the vascular pedicle dissection with selective rectus muscle harvest and abdominal wall repair, see Chapters 3 and 5 (Table 7-5).

Improvement in the abdominal appearance and a return of abdominal wall strength to preoperative levels has been the rule. Pre- and postoperative abdominal wall strength tests now being performed on these patients will provide more objective measurements of the return of abdominal strength.

Infection

One patient incurred an *Escherichia coli* infection in an unrecognized breast hematoma (patient 84). No other infections occurred except for those localized around slowly healing umbilical stumps.

All patients received intravenous cephalosporin 1 gram on induction of anesthesia and were continued on it in the appropriate dose (500 mg qid p.o.) until 24 hours after the drains were removed, at which time all antibiotics are discontinued.

Lateral Breast Atrophy (Wasting)

Two patients (Nos. 14 and 41) experienced a wasting of the fat in the lateral breast. This process appeared during the first two postoperative weeks as skin discoloration and was complete in 2 months. There was no skin loss or drainage and no breast firmness. Both of these patients were extremely thin with abdominal striae. This fat loss occurred on the nonpedicle side of the flap, and the wasting stopped in the midline. The error here is probably tension on the new

breast suture line, which tightened the skin across the flap at the umbilicus. In one patient the volume loss was not significant enough to warrant correction, and in the other patient a small implant was used with a good result. All other patients in this series have maintained their new breast volume and shape (longest follow-up is nearly 3 years).

Pulmonary emboli and postoperative ileus were not encountered probably because of preoperative measures and early postoperative ambulation (see Chapter 2).

Factors Affecting Flap Safety

Patient Selection

- The small vessel disease of smokers and of diabetics is detrimental to tissue viability in this flap.
- Patients with chronic pulmonary disease and malnutrition will experience problems with tissue viability and wound healing.

Flap Design

- Upper and lower flaps must include the periumbilical perforators (see Chapters 1 and 3); in the very high flap, the superior superficial epigastric vessels must be included (see Chapter 6).
- Also, special conditions, e.g., abdominal scars, require design alterations and adjustments (see Chapter 6).

Preoperative Patient Conditioning

- Isoxsuprine 20 mg four times a day for 2 weeks preoperatively has been used in all patients in this series.
- The patient must stop smoking 4 weeks before surgery.
- Good nutrition, B complex and C vitamins, and conditioning exercises are important.

Skilled Operative Performance

- When elevating the flap, rotating the flap on the chest, and shaping the breast, attention to critical details will ensure a well-vascularized flap with an unobstructed venous return (see Chapters 2 and 3).
- The new breast flap will not tolerate any tension on the suture line.
- The flap will not tolerate breast shaping by folding or rolling the tissue and then holding this form with sutures.

Intraoperative Management

- Avoid early vasospasm by replacing blood (volume for volume) as it is lost and by continuing isoxsuprine 10 mg intramuscularly every 6 hours. (A cold operating room has not been a factor causing vasospasm in this series. Warm saline has not been used.)
- Give methylprednisolone (Solu-Medrol) 1 gram intravenously in four doses.
- Maintain adequate hydration.

Postoperative Management

- Blood and fluid replacement is continued to keep pace with the continuing loss from the extensive abdominal and chest wall dissection.
- The flap must be monitored constantly, and signs of vascular difficulty should be responded to immediately.
- No restricting or compressing dressings are used.
- No brassiere is worn for 3 weeks.

The Sick Flap

Early Postoperative Management

As the patient is warmed, the color and temperature of the flap should steadily improve until a white to pink color is attained and tissue temperature is approximately 2°C cooler than that of the opposite breast. This optimal condition should be reached within 6 hours after the operation.

If the flap does not show this steady improvement, the following checklist of remedial maneuvers and medications may be useful:

1. Make sure that all blood lost is replaced, and as loss continues in the recovery room replacement should occur on volume for volume basis. Blood pressure readings, pulse rate, hemoglobin, and hematocrit values during this early postoperative period are of little value. If the

flap is in trouble and you think the patient might be behind on blood, ***give blood.***
2. Warm the patient.
3. Position the patient in bed with the flap side elevated to aid venous drainage of the flap. In bilateral cases, put the troubled side up and then switch from side to side.
4. Continue isoxsuprine 10 mg intramuscularly every 6 hours (patient should have received a dose at 12 midnight and at 6 AM on the day of surgery; the next dose is at 12 noon).
5. Give dextran 40 at the rate of 40 cc/hour. In smokers this is given routinely and started intraoperatively. This dose can be continued for 3 to 5 days postoperatively.
6. Keep the patient well hydrated.

Intraoperative Trouble Shooting

The patient with a mottled, cold flap which has not responded to the medications and positions previously mentioned (patient 22; Tables 7-3 and 7-4) should be returned to the operating room within a few hours. **There will be nothing gained and tissue will be lost by delaying open and definitive correction of the problem.**

Step 1

A flap with skin repaired under tension may be improved by releasing one suture line (one entire side of the flap). If flap continues to do well with no other treatment, the residual open area of the breast can be covered with a graft and the defect closed at a later date. If no improvement is forthcoming, further steps are immediately necessary.

Step 2

Open the breast pocket and release all deep sutures below the level of the pedicle. Remove all sutures that shape the flap. (High fixation sutures should not be removed unless the pedicle is under tension.) The tunnel should be examined for acute twists or folds in the pedicle. If the flap color improves with these corrective steps, the skin can be loosely repaired with superficial sutures only.

Do not be lulled into a false sense of security by an immediate improvement in flap color. Opening the wound and allowing the veins to bleed will give temporary relief of venous congestion and short-lived flap improvement. After the patient recovers from anesthesia and the body warms, the flap color and temperature should improve from one skin edge to the other.

Step 3

If the new breast is still mottled and cool after 3 to 4 hours (blood loss has been adequately replaced, dextran and isoxsuprine have been continued), immediate reexploration is indicated. The major vascular pedicle now must be exposed from the rib margin to the new breast. This exposure in the deep epigastric region can be gained in some cases only by a direct incision in this area. In the two patients in this series (Nos. 39 and 57) who required repeated reexplorations, the problem was finally traced to total occlusion of the deep epigastric vein by a thin (wirelike) band extending from the xiphoid to the rib margin. In both of these patients, the problem was corrected by complete exposure and isolation of the internal thoracic-deep epigastric vessel juncture. This was accomplished by resecting remaining muscle with the offending band and removing a segment of cartilagenous rib. It is interesting that in both of these patients the vein was completely collapsed by even a gentle folding over the fibrous band, but the artery continued to function. This experience emphasizes the fact that venous obstruction with tissue congestion is the problem in almost every sick flap. Both of these patients improved rapidly and dramatically with primary healing of the new breast without further tissue loss.

By following these guidelines and with experience there should be no flap tissue loss. The surgeon must be prepared to correct flap problems without harmful delays, and he should not hesitate to return to the operating room as many times as is necessary to correct the difficulty.

Management of the Smoker

Avoid the chronic heavy smoker. For the smoker who will agree to stop, the routine should be altered as follows:

1. Be more conservative in flap design and elevation. Use only tissue near the vascular perforators and include all of the periumbilical perfo-

rators. This usually means a smaller new breast and a slightly higher abdominal scar.

2. Use dextran 40 (low molecular weight) 40 cc/hour beginning intraoperatively or early postoperatively and continue until the flap is clearly doing well (at least 48 hours). This dose may be safely continued 3 to 5 days if necessary.

8

Office Forms and Patient Information Brochure for Breast Reconstruction after Mastectomy

PATIENT INFORMATION BROCHURE

Breast Reconstruction After Mastectomy

Using the Transverse Abdominal Island Flap Technique

Breast reconstruction after mastectomy has become a desirable procedure in recent years. Both surgeon and patient recognize the beneficial effects of restoring self-image and "wholeness" to women who have lost a part of themselves to breast cancer. The reconstructive options available to the patient now include the transverse abdominal island flap procedure, which uses only the patient's own body tissues and does not require an artificial implant.

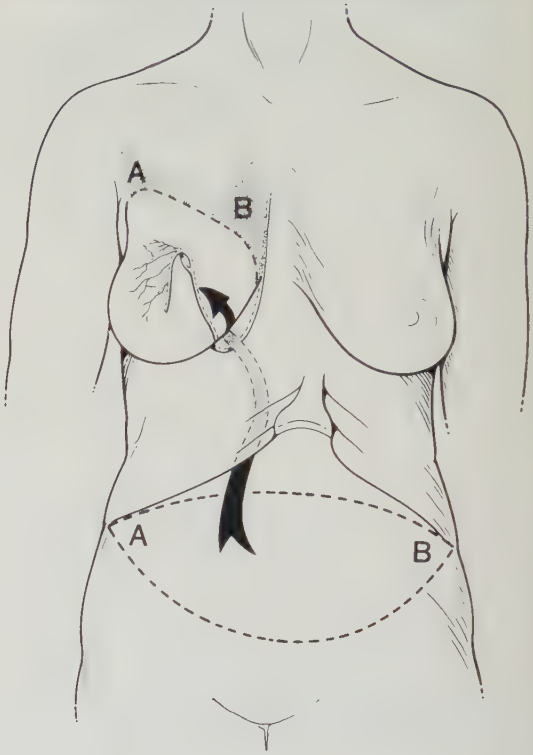
This brief pamphlet has been written to give you some general information and to answer the most often asked questions. Of course, your particular case will require an in-depth consultation with your reconstructive surgeon.

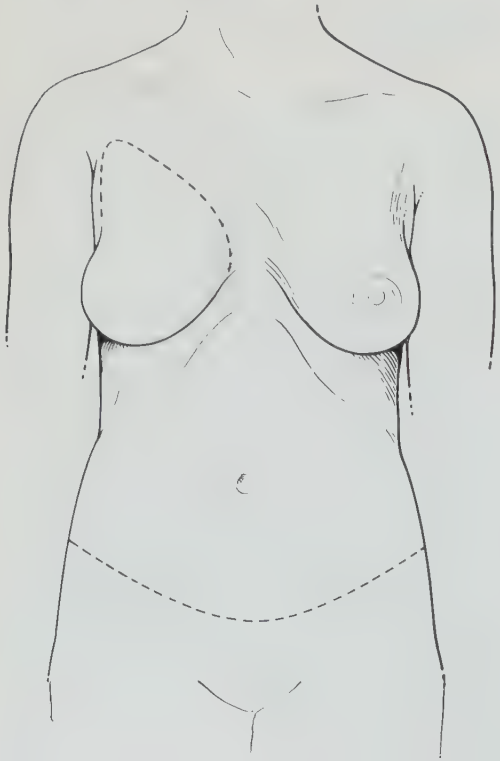
Transverse Abdominal Island Flap Technique

Although each patient's individual requirements dictate variations in the procedure, the basic concept remains the same. An "island" of excess abdominal tissue consisting of muscle, fat, and skin is transposed from the abdomen to the chest wall. The blood supply (artery and vein) to this island is carefully preserved and moved with the tissues. The old mastectomy scar is opened, and this island of the patient's own tissue is used to build a new breast without an artificial implant. The abdominal tissue removed is approximately the same amount as in a standard abdominoplasty ("tummy tuck")

This procedure was first performed at Saint Joseph's Hospital in Atlanta, Georgia in September 1980. Since that time it has been successfully performed on patients ranging from 18 to 70 years of age. In addition to mastectomy patients, the technique has been beneficial in patients with congenital defects, chest wall defects, and trauma problems.

The Transverse Abdominal Island Flap Operation





A. The superior epigastric artery and vein supply blood to the island of muscle, skin, and fat to be transposed. A segment of muscle from the abdomen is taken to support this artery and vein.

B. The island of tissue is tunneled under the mid-abdominal skin and brought out through the old mastectomy scar. This transposed abdominal tissue is then used to shape the new breast.

C. The resulting scars from the transverse abdominal island flap procedure are usually low on the abdomen (in the panty area) and around the new breast. As in the normal maturing process for all scars, redness persists for at least 6 months. The area then becomes pale as the scar softens with time.

Hospitalization

The surgery is performed under general anesthesia and usually requires a 5- to 7-day hospital stay. The operating time is usually 3 to 4 hours for reconstructing one breast and 4 to 5 hours for reconstructing both breasts. Generally, pain is not excessive with this surgery.

Preoperative Routine

General good health is important to the success of any surgical procedure. Patients are encouraged to prepare themselves as completely as possible in the following ways.

- Establish and maintain optimum weight through a well-balanced nutritious diet.
- Take a multivitamin every day.
- Stop all smoking at least 1 month prior to surgery and for 6 weeks after surgery.
- Exercise regularly, especially walking and situps to strengthen the abdominal muscles (situps in the knees-bent position).
- Discontinue any medication containing aspirin products 2 weeks before surgery.

There will be additional specific instructions and medications to take before surgery.

Postoperative Care

The average patient can expect to experience the following progressive stages after surgery.

In the Hospital

- *Day 1 Postop:* The patient is assisted to the bathroom and sits in a chair for brief periods.
- *Day 2 to Day 7:* Increased activity; short walks are encouraged; normal diet.
- *Day 3:* Shampoo and shower.

At Home

As with any major surgery, it takes time to regain normal energy and activity levels. To aid in recovery, patients are encouraged to:

- Rest when tired and not over do.
- Eat small meals more often (the tummy is tighter now).
- Maintain optimum weight and avoid gaining weight.
- Follow the exercise schedule assigned after surgery.
- Maintain a positive outlook and understand that *healing takes time.*
- After 3 weeks limited driving is permitted. After 6 weeks all routine activity may be resumed with the awareness that it may take 6 months to 1 year for complete recovery.

What About the Other Breast?

There are several considerations to be discussed with your surgeon regarding the other breast.

1. Will the breast need to be altered (reduced or uplifted)?
2. What are the chances of cancer occurring in the remaining breast, and (if the risks are significant) should the breast be removed and a bilateral reconstruction performed?

Bilateral Mastectomy

The transverse abdominal island flap technique is especially useful when reconstructing two breasts. In most women there is sufficient excess abdominal tissue to reconstruct two breast mounds.

The Patient with Complications from Silicone Implants

In some cases of complications from previous breast reconstruction using a silicone implant, the implant can be removed and the transverse abdominal island flap technique used to reconstruct the breast without the use of an implant.

How Natural is the "New" Breast?

Once a breast is surgically removed, that breast can never be exactly replaced. The aim of breast reconstruction is to achieve a reasonable facsimile, however. The transverse abdominal island flap technique produces a pleasing breast mound which is soft and of good size and shape without using an artificial implant. Even though the reconstructed breast will not be an exact replacement of the original breast, most patients are very pleased with the reconstruction.

Nipple Reconstruction

Of course, the newly reconstructed breast has no nipple. If desired, nipple reconstruction is performed in a second operation usually 3 to 5 months after breast reconstruction. It requires only a short hospital stay, and in some cases it can be accomplished on an outpatient basis using local anesthesia. There are several methods of reconstructing the nipple. The surgeon must decide (with the patient's input) the best technique for the individual patient. The reconstructed nipple will not exactly match the natural nipple nor will it have normal sensation.

Costs

Because each patient has a different set of circumstances, an exact cost of reconstruction cannot be predicted until the patient has been examined. However, the operation does require a team of specialists including the primary plastic surgeon, an associate surgeon, surgical technicians, and registered nurses, and so it is moderately expensive.

Insurance Coverage

This is not cosmetic surgery. The majority of good health insurance companies pay benefits for breast reconstruction after mastectomy for cancer patients. After the doctor has evaluated the patient's case, he will write to the insurance company for prior approval before the surgery to determine coverage provided by the specific policy. Of course, the patient is responsible for any amount not covered by insurance.

Conclusion

This brief pamphlet is not intended as a substitute for a consultation with the surgeon. Other topics of consideration should be the possible recurrence of cancer, possible complications, and the individual concerns and expectations of each patient.

A successful and satisfying outcome for the patient and the surgeon depends on a realistic understanding of the limitations as well as the advantages of the procedure.

If other questions or if you make an appointment, please call

Questionnaire for Breast Reconstruction Patients

DATE: _____

BY: _____

NAME: _____ MARITAL STATUS: S M D W

AGE _____ HEIGHT (Approximate) _____ WEIGHT (Approximate) _____

ADDRESS: _____

CHEST WALL DEFECT

	Right	Left	
Date:			Radical mastectomy
Date:			Modified radical mastectomy
Date:			Subcutaneous mastectomy
Date:			Implant or previous reconstruction
At Birth:			Congenital deformity
Date:			Other

PATHOLOGY: Number of positive nodes _____

CHEMOTHERAPY? _____ Date Completed _____

RADIATION? _____ Date Completed _____

REMINDER: PLEASE FORWARD TO THIS OFFICE ALL PREVIOUS

- Pathology reports
- Operative reports
- Chemotherapy record
- Radiation treatment

GENERAL HEALTH: Diabetes? _____ Hypertension? _____ Other? _____

MEDICATIONS? _____

ABDOMINAL SCARS? _____

SMOKER? _____ How Much? _____ How Long? _____ Will Patient Stop for Surgery? _____

HAS ANY FAMILY MEMBER HAD BREAST CANCER? (If so list relationship and age at onset)

_____

_____

ONCOLOGIST/INTERNIST (NAME & ADDRESS): _____

_____

SURGEON (NAME & ADDRESS) _____

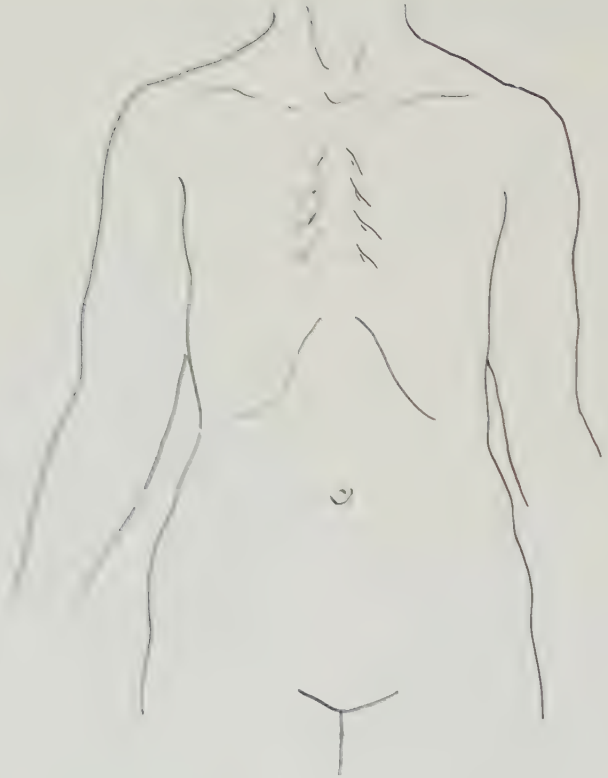
_____

IS PATIENT'S REPORT TO BE MAILED TO HER PHYSICIAN? (If so list name and address)

_____

SOURCE OF REFERRAL (M.D. OR OTHER): _____

COMMENTS: _____



Mark All Breast, Chest and Abdominal Scars

	Preop date	*One year postop date*
WEIGHT:		
NUMBER OF SITUPS:		
Hands behind head, knees bent, feet flat		
Hands toward feet, knees bent, feet flat		
CIRCUMFERENCE OF BODY AT:		
Inframammary line		
Umbilicus		
Pubis		
CIRCUMFERENCE OF ARM ON MASTECTOMY SIDE AT:		
Mid-humeral level		
Mid-forearm level		

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